

# Aviation Week

and *Space Technology*

October 9, 1961

**SPECIAL REPORT:**

## Lockheed C-141 Development Program

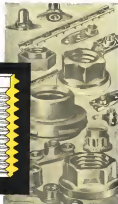
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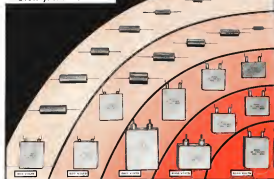


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## AVIATION CALENDAR

- (Continued from page 5)
- Intelligence Weapons Meet, Tyndall AFB, Fla. Host: Air Defense Command.
- Oct. 24-26—Air Traffic Conference, Air Transport Assn., Marriott Twin Bridges Hotel, Washington, D. C.
- Oct. 24-26—International Symposium on Atomic-Space Nuclear Propulsion, IRL, Ramon Hotel, Las Vegas, Nev.
- Oct. 24-26—Air Transport Assn.'s Engineering and Maintenance Operations Meeting, Americana Hotel, Miami Beach, Fla.
- Oct. 25-27—Annual Convention, Southwestern Airport Managers Assn., Tuna Hotel, Mexico, La.
- Oct. 25-27—Joint Electronics Devices Pacific Coast Regional Meeting, Assn. on Composite Systems, Jack Tar Hotel, San Francisco, Calif.
- Oct. 26-27—Quarterly Regional Meeting, Assn. of Local Transport Airlines, Solano Hotel, San Diego, Calif.
- Oct. 26-27—Third Annual Symposium on High-Speed Testing, Hotel Somerset, Boston, Mass. Sponsor: Plan Tools Equipment Corp.
- Oct. 26-28—Electronics Devices Meeting, in honor of Radio Engineers, Sheraton-Park Hotel, Washington, D. C.
- Oct. 29-31—International Symposium on Piezoelectricity, Glendon Institute of Technology, Chicago, Ill.
- Oct. 30-31—San Diego Field Power Conference, Fairmont Shady Hotel, Detroit, Mich. Sponsor: Aero Hydraulic Division of Victor Inc.
- Oct. 30-Nov. 1—Annual Meeting, Air Traffic Control Assn., Des Moines Hotel, Miami Beach, Fla.
- Oct. 30-Nov. 1—Technical Symposium on Aerodynamics, Sheraton Hotel, Dayton, Ohio. Sponsor: Navalized Systems Division, Air Force Systems Command.
- Nov. 1-3—First International Congress on Experimental Mechanics, Society for Experimental Stress Analysis, Hotel New Yorker, New York, N. Y.
- Nov. 3-8—Trends and Challenges of Air Transportation, Symposium, Sheraton-Crown Sponsor: Continental General Life Insurance Co.
- Nov. 6-8—Special Turbulence Conference on Non-Linear Magnetic, Institute of Radio Engineers, Sheraton Hilton Hotel, Los Angeles, Calif.
- Nov. 6-8-1966 Conference and Minisymposium, American Nuclear Society and American Nuclear Society, Conrad Hilton Hotel, Chicago, Ill.
- Nov. 9-13—Fifth Annual Dayton, Aerospace Technical Society of San Diego, Rialto Park, San Diego, Calif.
- Nov. 9-10-11th National Conference, Aircraft and Missile Design, American Nuclear Society, San Diego Convention Center, San Diego, Calif.
- Nov. 14-16—National Electronics Research and Engineering Meeting, Institute of Radio Engineers, Commercials Service and Southern Hotel, Boston, Mass.
- Nov. 20-26—3rd Meeting, Aviation Districts and Manufacturers Assn., Jorg Hotel, New Orleans, La.
- Dec. 5-7—Annual Convention, National Aviation Trades Assn., Rialto Hilton Hotel, Washington, D. C.

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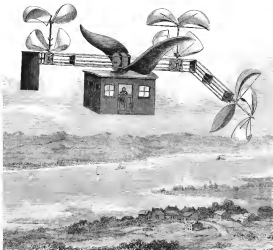


## WARNING ON THE WING

Skimming over the surface of the sea, the Navy's patrol craft serves as a sharp-eyed, advance hunter in ASW operations transmitting vital target data to war-craft attack teams. Norden's compact, lightweight navigational computer, accepting signals from a Doppler velocity sensor, can provide the pilot with a continuous display of wind velocity and distance traveled during a sortie at the scene. In the absence of Doppler returns, the computer continues to provide distance data based on air and computed wind information.

Developed by Norden for the Naval Air Development Center at Johnsville, Pennsylvania, the navigational computer is further evidence of the company's capability in the art of advanced electronics and another step toward

Extending Man's Capabilities



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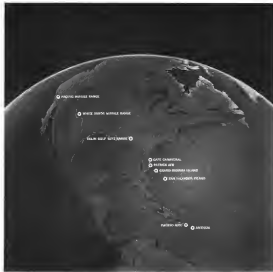
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## THERMOPLASTIC RECORDER/DISPLAY SYSTEM

Ground-level detail  
projected to vehicle  
for immediate use

At 10,000 feet and higher a pilot could spot ground-level targets no larger than a tank by using a new recorder/display system developed by General Electric's Light Military Electronics Department. A photographic view is obtained from side-looking radar, recorded on thermo-plastic tape, and displayed instantly on a screen in the cockpit. Requiring no cathode ray tube, the screen has variable brightness that permits operation in ambient light, without the use of a hood.

At extreme heights—or in space—the system is capable of providing great detail and a permanent data record of TV, infrared, or any other "eyes" of the vehicle. Combined or composite displays are also possible for integrated display applications. The thermo-plastic recorder/display system is a typical example of LMED contribution to progress in aero/space electronics.

**GENERAL ELECTRIC**  
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## Toward Genuine Competition

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One of the key problems in ensuring development and producing the new technically complex weapons are those required for modern military forces has been the lack of genuine competition in the critical phases of this cycle. As the nations have grown more technically complex, and expanded the areas of competition have diminished in the key phases of prototype development and production and tended to concentrate on the initial conceptual phase. Vice Adm. John A. Howard, deputy chief of naval operations for development, performed a significant service recently in a New York speech when he turned the public spotlight on this problem (see p. 38).

The government, through Congress, and the civilian infrastructure in the Pentagon and the military services must share equal responsibility with industry for this trend. As Adm. Howard pointed out, this trend now results in most of the competitive element of our new weapons without development programs being concentrated on the proposal stage, where there is the least possibility for real genuine competition. This type of competition can easily degenerate into a high-powered huge contest distinguished by the most glittering technical double talk, or a triumph of brochuresmanship, where the best attack and most elaborate charts turn the tide. We well remember the savings of one Navy aircraft who was still securing a week later over the attempts of a top corporate official of an engine manufacturer to sell the Navy a new turboprop aircraft which, on the basis of a beautiful brochure, convinced the committee of the merits of the machine and a set of "words thrust for his life" specifications, unsupported by the faintest trace of engineering data. There is also a school of radical sales that backs on the left's promise then anything to get over the first in the door and we can lead them up with our later technique to gather the usual development contract, and then apply tactics to the contracting service after the competition has expanded and they sit in the side source seat.

On the other hand, the services have been succumbing to the shift of competition to this proposal phase as weapons systems become more costly and technically complex, because it makes their budgets and the non-personal outlayings appear to be less expensive than running parallel competitive development programs through at least the early hardware testing stages. And although Congress is always beating the drum publicly for more competition in military procurements it never fails to bolster service chiefs, when they try to achieve genuine technical competition over their allegedly "wasteful duplications." The fact that the cost of preparing the tremendously (and needlessly) detailed proposals for new weapons competitions is running into astronomical figures—eventually passed back to the government by one accounting technique or another—seems to escape these congressional accountants and advocates of the competitive free enterprise system.

This also fails to consider the tremendous stack of

expensive dollars wasted on what Adm. Howard calls "buckin' now"—programs that failed because of a lack of genuine technical competition in their development phase. Another waste factor in the competitive hardware marketplace is the huge number of engineering man hours that are wasted annually in preparing the astronomical proposals. If this talent was applied to the solution of the many problems arising in the development cycle, instead of producing glimmering theories dressed in engineering trappings for proposals our technical progress would indeed be accelerated.

On the surface, this trend toward making the proposal phase the key competitive arena may appear to be efficient and economical, but in fact it is wasteful of both money and technical talent and too often produces an other addition to "buckin' now" instead of a combat-ready weapons system or significant conceptual threat.

As Adm. Howard emphasized, there is standard evidence in "buckin' now" and in some new technical still being harbored that no one administrator or committee can be very successful at picking winners at the hardware marketplace phase. However, experience has also shown that it is relatively simple to judge the competitive performance of competing systems when they reach the early hardware stages. We heartily agree with Adm. Howard and the other military technicians who have supported his view that prototypes are better competitors than paper proposals, and offer more genuine economic and combat effectiveness than the cheap elements provided by the single source concept.

In addition to creating genuine competition in the main weapon systems in building and testing prototypes, there is also a problem in maintaining this type of hard technical and economic competition down through the major subsystems and component developments. Too often, usually new technical steps have been attempted without losing a reflective, hard foundation of development through these subsystems and components. This, too, has been amply demonstrated to be false economy.

We have two current examples where the competition is being limited to brochuresmanship, and with all due respect to the best brochuresmen, the results will inevitably cost more, take longer and produce a less satisfactory technical result even if they avoid becoming additions to a permanent patch as "buckin' now." This is in the military V/STOL transport and the tactical fighter programs. To an extraordinary extent the single source selection after a better battle of balances in the hardware phase may appear to be a safe and logical solution. But 50 years of astronomical development history have proved this theory to be a mirage.

If we truly believe in the competitive merits of the free enterprise system, let's spend a little more money in more competitive prototype development in both prime and subsystem development and stop wasting infinitely larger sums in post-production progress of technically inferior and unreliable hardware for the combat inventory.

—Robert Hutz



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## WHO'S WHERE

### In the Front Office

**M. L. Davis**, a director, Collins Radio Co., Dallas, Tex. Mr. Davis is vice president and general manager of the company's Information Source Center.

**Ned M. Blair**, president of Amphipol-Ring Electronics Corp.'s newly established F&E Division, Danbury, Conn.

**John J. Rogers**, executive vice president, Cleveland Pneumatic Industries, Inc., Cleveland, Ohio.

**George E. Kirk**, executive vice president operations, United Air Lines, Inc. Also **Paul A. Bowen**, senior vice president operations, representing E. F. Maggioni, in turn; **F. A. Muehl**, vice president and maintenance for Franklin C. E. Hurdick, vice president-operations, American East, Warren, E. Kentucky, vice president management services and controls.

**J. J. O'Brien**, a vice president of The Garrett Corp., Los Angeles, Calif. Mr. O'Brien continues to manage of Garrett's Aircraft Maintenance Division at Arizona. Also **Jack Lewis**, vice president manufacturing.

**Harve E. Stuart**, treasurer, Thompson Ramo Wooldridge Inc., Los Angeles, Calif., representing Ernest C. Berthel, vice vice president finance.

**J. Lansing Campbell**, vice president finance and controller, Link Division of General Precision, Inc., Binghamton, N. Y.

**E. John Finkler**, executive vice president planning, Finance and Planning Department, American Airlines Inc.

**D. E. Ryan**, assistant to the president of Rockwell, a division of North American Aviation, Inc., Canoga Park, Calif.

### Honors and Elections

**Gerald J. Lynch**, vice president of Ford Motor Co.'s Defense Products Group and general manager of the Automotive Division, has been elected chairman of the board at trustees of the National Science Foundation.

Also **E. V. Hughes**, chairman of the executive committee and vice president of Westinghouse Electric Corp., was elected president. **Thomas Miller**, head chairman of Melcor, Inc., was elected vice president.

### Changes

**Wayne D. Shuman**, News program technical manager, Aerojet-General Corp., Azusa, Calif.

**Lawrence V. Caprice**, supervisor of R & D flight field support, Fordist Support Division of Johnson Electric Products, Inc., Buffalo, N. Y.

**Hubert K. Gages**, public relations assistant, Aircraft Division, Douglas Aircraft Co., Inc., Santa Monica, Calif.

**Alfonso C. Minetti**, general manager of the newly established Data Acquisition Department of the Communications and Weapons Division, General Dynamics Industrial Group, Fort Worth, Texas. Also **Charles P. Woodward**, director of engineering, and **Joseph S. Newman**, engineering director of engineering, William Sperry, also managers.

## INDUSTRY OBSERVER

► **Beam-riding** attitude guidance system that would employ a narrow beam of light produced by an optical maser, rather than a radio beam, may be used in at least one major industrial weapon system. Advantages would be the extremely high resolution made possible by the maser's highly collimated light beam, and the difficulty in jamming the maser.

► **At Free** has retained the schedule for the Douglas Aircraft Co.'s Sikorski air-launched ballistic missile to allow development of the missile, which has been lagging, to avoid a serious timetable. Sikorski progress now is being run by Harold E. Bower, the third successive program manager to be named in one year. Previous managers were replaced because of failure of the missile to meet schedules, not because of cost overruns, which also have bothered the project.

► **Larger satellite** that could circle the earth, obtain high resolution maps and return to earth at being captured by NASA (see Propulsion Laboratory Proposed by Space Technology Laboratories, the satellite would be based largely on coating technology. Proposals believe it could supply useful data in two years. Satellite is not related to the lunar orbiter planned for launching on the Surveyor program (AVF Oct. 17, p. 27). Larger would transmit data back to earth but would not be retrievable, and associated problems would be of lower quality.

► **NASA's Jet Propulsion Laboratory** is reviewing the needs and problems associated with supply and use of a space station base. One question under study is what control can be placed on the moon to help control the Apollo mission before the first Apollo crew arrives.

► **Use of radiating exhaust** nozzles spaced along the trailing edges of the outer blades of the Westinghouse-Kutzbach VTOL engine is being evaluated in noise suppression studies. Each blade has two nozzles approximately 3 in. in diameter. Static tests indicate this approach might lower takeoff and landing noise to about 85 db. Westinghouse is evaluating a turbo-fan type of a new design (AVF Sept. 13, p. 41) and expects to adopt the cheapest and quietest method.

► **Weather** will greatly affect the timing of the first manned Mercury orbital flight if it is not made in December. Chances are 90 to 1 that it can be launched on a December day, but weather in the two short landing zones deteriorates rapidly from late December through February, and chances drop to 10 to 1 if the launch is not made by late in the year it could be postponed until next March.

► **Some 115 graduates** of Air Force's test pilot school and try Strategic and Tactical Air Command pilots have been awarded at USAF's Aerospace Medical Laboratory in current knowledge of the "space suit" for space missions. Profiles of physiological characteristics and performance under stress are completed, but studies are only to establish a framework for selection of future astronauts, not to produce a reserve supply of pilots.

► **Condor Aircraft** and Chrysler Corp. will develop a 300-ft. diameter inflatable orbital space station under a NASA contract. Amount of the contract is approximately \$100,000. Station will be used in studies of production of artificial gravity by rotation.

► **First unmanned flight** of a Lockheed QF-104 target drone is expected in mid-October at Eglin AFB, Fla. Many remotely controlled flights have been made but always with a pilot aboard as backup.

► **NASA's Space Task Group** would like to acquire North American T-19 utility jets for astronaut proficiency training and transportation. Astronauts now have access to two USAF Convair F-106s but maintenance is a problem.

► **New type of powered orbit vehicle** that can transport 35 passengers at a speed of about 10 mph, has been designed and successfully tested, Hamilton says. It is 50 ft. in length and is built of light metals and plastics.



First 20' diameter corner section of thermal vacuum chamber under construction at Bendix Space Laboratories, Inc., in Columbus, Ohio.



Second stage savings in space. No structural members are visible in this view of 40' diameter, 10' high window.



Work port cutouts reduce weight. No structural members are visible in this view of 40' diameter, 10' high window.



Full working head being mated to chamber wall above internal mounting of full-size satellite and ground support.



18" depth barrel mounted at floor and 10' diameter, 10' high window in floor.



Full-sized chamber under test. No structural members are visible in this view of 40' diameter, 10' high window.

**MAJOR EXPANSION** of the Bendix Space Laboratories offers new career opportunities for engineers to develop and test tomorrow's spacecraft and space capsules. Our new facilities, such as the 20' x 27' thermal vacuum chamber, open key positions in management and supervision for personnel experienced in the integration, assembly, and testing of satellites. Specialists are needed for RFI, heat transfer, thermal-vacuum, vibration, structures, packaging, weight-and-balance, circuit design, and field test. Write Personnel Director, Ann Arbor, Michigan.

Qualified applicants will receive consideration for employment without regard to race, creed, color or national origin.

**Bendix Systems Division**



## Washington Roundup

### Dyna-Soar Review

Final decision on what to do with the Dyna-Soar boost glider project will be made after Air Force gives Defense Secretary Robert McNamara a special briefing, probably next week. He called for a re-evaluation of Air Force's entire case, partly as a result of his five-hour talk with Boeing officials on a visit to Seattle last month.

Critical point in Air Force's failure to far to compare the Secretary and Air Force's in the Defense week-end and expanding effort that it really needs the glider for military mission. Congress voted \$153.5 million for Dyna-Soar for fiscal 1963—\$35.5 million more than the Administration asked. Nevertheless, moves are being considered to cut the project back, possibly even to eliminate all related flights, and shifting it to National Aeronautics and Space Administration, which is now Dyna-Soar technical adviser.

Some civilian critics in the Pentagon feel that manned spaceflight should be handled by NASA, not a military unit, because clear. They think both the X-45 and the Dyna-Soar should have been NASA projects from the start because they are both as desired research projects. They also have been urged by the recent study of Air Force and civilian scientists on the relative importance of space research and space weapons.

### Project Highspeed

Project Highspeed, an attempt to determine whether the single-engine, single-phase USAF General F-106 interceptor or the two-engine, two-phase Navy-McDonnell F-4 Phantom II is better as a replacement for the aging F-105, is being both by the Air Force and the Navy. The Air Force and Navy plans are being both by the Air Force and the Navy. The Air Force and Navy plans are being both by the Air Force and the Navy.

Defense Department has suggested to Air Force that it look at the Navy-North American A-1F for supersonic bomber mission. All those weapons and fuel efficiency and other space tanks and weapons mounted, using rocket boosters.

Army Gen. Paul Adams, commander of the newly activated USAF Tactical Air Command and Army Strategic Air Command joint operations force, has recommended Maj. Gen. Bruce K. Holloman, Air Force director of operational requirements, as its deputy and Brig. Gen. Clifford Van Kester, director of Army aviation, as his operations chief. The joint command from TAC and STRAC officers to the joint force has been surprisingly successful.

### Soviet Visa Trouble

Soviet scientists attending the 19th International Astronautical Congress last Oct. 12 still had not received visas last week to attend this week's Space Flight Exposition in the Nation in New York. It is a national meeting and State and Defense had agreed several requests for permission for U.S. scientists to attend national meetings in Russia—although both countries permit attendance at international meetings. Still, the embassy of the embassy of scientists was too heavily in Russia's favor. Meanwhile, Maj. Gen. Mikhail Kozlov, Russia's air attaché here, was among the New York visiting because he is a member of the sponsoring American Society.

U.S. and Russia have been invited to Geneva to help International Telecommunications Union officials develop recommendations for space communication systems before the 1965 ITU conference. Sovietian General Gerd Gerd and ITU cannot now become an operating agency for communications satellites but can serve as a meeting for developing agreements. He noted that the cost of establishing a communications satellite system is 10 times more than the total ITU budget since it was founded in 1876.

### Aging Astronauts

All seven astronauts have had their last duty with NASA extended for a second three-year term, which runs into 1968, at which time they will be about 41 years of age. There is a good chance that none of them will ever fly with NASA for the Apollo program, but because of age they may advise rather than fly.

E. M. Cortright, now assistant director of space flight program for house and planetary program and acting assistant director of program planning and coordination in the space flight office, will be named as Dr. Homer E. Newell, Jr.'s deputy as the new space sciences officer.

Deputies are involved in whether to proceed with development of USAF's Pluto nuclear engine. An ad hoc committee named by Defense Secretary Robert McNamara is completing its report. USAF has asked for \$71 million in the next two fiscal years.

Nuclear payloads that will be reduced in weight and shifted into the Atlas-Centaur to the Atlas-Centaur B booster (AW Oct. 2, p. 16) have been designated Minotaur K, with K standing for Ranger Jet Propulsion Laboratory's modified nose for them in Minotaur—combination of Minotaur and Ranger.

—Washington Staff



## Defense Plans to Spend \$6.5 Billion Through 1970 for Tactical Fighter

Washington—Program for FY 65 before that extends through 1970 has been scheduled in the Department of Defense for the TFX tactical fighter.

Reports for proposals sent to an Atomic Companies Sept. 29 are needed in such a way that differing Air Force and Navy requirements would be met by using a single basic airframe but using divergent approaches for armament, fire control and fuel capacity. Proposals are due at the Air Force Headquarters Strategic Division on Dec. 5.

A late start would mean the proposals for the new fighter design will be May. Gen. W. Austin Davis, ASD, comments: "The Navy member will be Gen. John F. Roberts, L. A. Roberts, assistant chief of the Division of Naval Weapons for research, development, test and evaluation. No determination had been made late but work as to who the other two Air Force members would be. One member will be from the Tactical Air Command and the other from the Strategic Command or the Logistics Command."

The specifications call for a two-engine aircraft. Weight and performance qualifications are such that the Pratt & Whitney JTF-30 (JT30A) is the only engine that meets

requirements. Its engine thrust rating of 11,250 lb. is already been boosted to over 20,000 lb. and it has a growth potential beyond that.

Air Force requirements include a capability for transonic maneuverability for four purposes. To achieve a greater fuel load it wants a low complex fire control system that is to be modular, probably an improved Sidewinder equipped with radar or conventional high explosive warheads. Air Force also wants the capability of high explosive loads for 200 miles at Mach 2.2.

Navy does not desire the long range and wants a more sophisticated missile system. The long range Eagle missile was for research along with development was halted that in first stage could be straggled and the second stage shortened. It would be the same guidance system originally designed for Eagle.

Air Force allows only 2,000 lb. of the 60,000 lb. gross weight of its version (as compared). Navy allows 6,000 lb. of its 15,000 lb. gross weight. Both services have agreed on the variable geometry wing concept.

The final portion of the Air Force before a two-engine configuration was

### Houston Site Criticized

Washington—A Boston official, perceiving criticism, National Association and Space Administration are expected to permit with increasing frequency in the space program equals but work and the space program, perhaps, part of the whole space program, but overall, and maintained the cost of it." In selecting Houston, Tex., for its manned space flight center.

Epstein Galt, president of the Greater Boston Chamber of Commerce and Boston's cultural authority, says: "I don't think Houston with its Jim Crow tradition is going to be able to do this." He said. The Jim Crow tradition also would increase the cost of the space program, he said.

Boston was one of many locations that hoped to obtain the space center. Galt and his critics did not expect to see in their Texas work, and added that Texas congressmen were "too powerful and united."

search records (AW Sept. 31, p. 38) was for a 75 ft long aircraft weighing 50,000 lb. considerable smaller than the original position of 52 to 92 ft and 90,000 to 15,000 lb. The Navy program was for a 50 ft length and 15,000 lb. The Navy is willing to cut only on the length but has set the 15,000 lb. limit as its refusal point. If this is exceeded, Navy can withdraw from the program.

Republic Aviation Corp., Boeing Co., North American Aviation, Inc. and Lockheed Aircraft Corp. have spent cooperative funds in developing the TFX design.

In a related field, the Fiscal 1963 budget will contain an increase of 400 Douglas A-10 single place, single-engine attack aircraft for use by Air Force's Tactical Air Command. Further, various of the aircraft are currently operational to the Navy and Marine Corps. Although the language of a Defense Department directive sent to the Air Force recently said Air Force and has "A-10 or similar aircraft."

In its various close support attack, it is indicated that the intent is that the service want but a relatively sophisticated aircraft that can perform close support. This characterizes higher speed vehicles such as the Republic F-105 for this particular mission.

The total program for close support aircraft is 1,500 aircraft by 1965. Of this total, 400 will be the A-10, mentioned above and the remainder will be the VAX, close support fighter, which is yet to be developed.



## Photos Reveal Soviet Mil Crane Design Details

Forward landing gear arrangement of the Soviet Mil being given with which the Russian broke through records for helicopters (AW Oct. 2, p. 31) shows differences from the one just shown at the Yarkov 24 show (AW July 17, p. 31). Forward has been added to the internal V lifting system, and the width of the V system is also increased. Small diameter tubing extending from cockpit area to fuselage housing for the gear. Cockpit appears to have two between the pilot and copilot with pointing access to the cargo handler's platform. Cockpit is on the belly side windows on cockpit are hinged shaped to permit observation below and behind. Closure of side hatch of the crane (bottom) and the Mil-6 (center), which are a good record of the same form, view difference. Crane body is large, and Mil-6 does not have the long sleeve section at the rear, those of the Mil-6 do. Mil-6 blades are straight, but blades of the same appear to be long.



### Sikorsky Designs Assault Transport Helicopter

Sikorsky has proposed a new heavy assault transport helicopter shown here in model form, to the military. The helicopter, which may be based at a Marine Corps requirement, uses the S-61 rotor system with a new landing gear. The new helicopter would have a four-blade rotor, which would increase its rate of climb for short range flights. Other features include variable loading, a new landing gear with a hydraulically operated ramp, retractable landing gear, main rotor speed, retractable blade and tail folding sections, and all weather operation. Sikorsky recently has been looking for an S-61 concept, which also uses the S-61 rotor system with a new landing gear (AW Oct. 1, p. 45).

# Vice President Begins Nationwide Tour of Major Space Installations

By Edward H. Kohnen

Los Angeles—President Kennedy has devoted to support the space program as a personal issue through Vice President Lyndon Johnson, who last week began a tour of space installations that necessarily will include all major research, military and possibly industrial facilities in the country.

The Vice President made it clear that the Kennedy Administration is under space as one of the most critical aspects of U.S. foreign and domestic programs and he wants to assure itself that all efforts are designed to demonstrate that backing.

Johnson, who also is chairman of the National Aeronautics and Space Council, last week visited the Aerospace and Space Administration facilities at Ames Research Center, Edwards field and rocket test center, Jet Propulsion Laboratory and Vandenberg Air Force Base in California. He also visited the Air Force School of Aerospace Medicine at Brooks AFB, Tex., and announced plans to visit NASA's Saturn assembly plant at Michoud La., and the Atlantic Missile Range in Florida in two weeks.

Johnson said he expects to coordinate the personal visits to Air Force facilities and space industrial plants "I am going to all centers, and the going to know the people in all of them."

Johnson told, however, that all his steps to emphasize the dependence

of the space program on field installations. In Washington he said, "We can make policy but we can't make hardware."

The Vice President began his tour shortly after returning from Stockholm in the U.S. representative of the Council of United Nations Secretary General Dag Hammarskjöld and he said that part as the people in the North American Treaty Organization will be ready to get everything they have into a joint effort of our future "we want to get everything we can into the space effort."

But why the hell do we have to wait for the bomb to drop?

After his usual visits Johnson said that most of the major space efforts have been made. He added appreciation, which has resulted in accelerating the overall program in several months. He learned that in the case, however, that NASA cannot compete with industry, it stands. Several top Ames research scientists have left the government within the past two weeks.

The Vice President obviously wants to build a feeling of confidence in government work, because he told the top officials at Ames that President Kennedy is meeting on work and letting "me."

The space council apparently is growing rapidly in importance as the past year's progress to the Administration on space policy. One of the Vice President's aides characterized the council as an agency that is gaining the capability through a small, competent staff to recommend approaches to space that will fit into the overall government program.

## Avoid of Conflicts

He said the space council probably will never grow to more than 20 men, who will be a mixture of specialists in government, law and science. He added that both the Vice President and the space council are fully aware of the conflicts between military and civilian space programs but said the conflicts are being solved in the point where the President can make a decision on them.

The aide said NASA will have the major space role, and the Defense Department will be a customer—not of the civilian agency but of a combination of civilian and industrial space technology.

The Vice President's visits to facilities are designed to give him a broad brush look at current capabilities in the U.S. Third leg of the tour ended

• Ames, which included discussions

at pilot simulation of the Apollo space craft, problems areas in magnetic force field landing, demonstration flight of a C-130 with ionosphere, light control and an X-14 with variable stability, stability and performance during reentry, from an aircraft carrier, and other research.

Dr. South J. Deffenre, Ames director, said that was the first time in his more than 40 years in a government position that he has been visited by a ranking Administration leader. Rep. George Miller (D-Calif.) chairman of the Science Committee on Science and Astronautics joined the Johnson party during the Ames tour.

• Edwards, which included discussions on the X-15 project and result on ionized X-15 observations during the test two to three times. There are five members of spacecraft flight control system stations observe related photographs photographed by the earth's atmosphere, and demonstration flights of satellite research instruments.

## Abort Technique

Technique to be used for an abort in the launch phase of a Dyna-Soar boost glider flight was demonstrated with an aircraft similar to a low altitude bombing system (LABS) aircraft to bring the vehicle to a landing strip.

Dissemination of a flight of a rocketed X-15, which is three times the speed of sound, is being used because of a safety reason.

• Jet Propulsion Laboratory, including briefings on lunar and planetary programs, a demonstration of flight 1, the lunar probe and other lunar and planetary programs on the vehicle. Melpolder was shown of the latest test launch Soyuz to visit in the Mariner spacecraft.

• Vandenberg facilities used by NASA, which include the Thor Agena B complex 771.1 the biological probe under construction. Various communications and time delay experiments.

## NASA Landed for Aid To Small Contractors

Washington—National Aeronautics and Space Administration "is doing an outstanding job to meet small business in obtaining their line of the research and development effort," according to a House Science and Astronautics Committee report.

The 15-page report said NASA can assist 16% of its research and development in small business. To assist that this trend continues, the report recommended that projects be broken down into "small packages" whenever possible.

# Booster for British Satellite Is Switched

Washington—British International Satellite No. 1 has become too large and heavy to be launched by National Aeronautics and Space Administration Scout launch vehicle and will have to be launched by the NASA Delta.

The four-stage solid-propellant Scout can lift 150 lb into a 300 mi earth orbit. The British satellite also known as U.K.-1, single 128 lb lot is to be put into an orbit with a 200 mi perigee and 600 mi apogee. The large Delta vehicle, which uses a Douglas Thor in the first stage, can lift 500 lb into a 300 mi orbit.

The change in plans was made Sept. 5 and announced last week to launch services attending the 11th annual International Astronautical Congress here. By Arnold W. Insler, director of international programs for NASA. The change also means that the launch will be from Wallops Island, Va., to Cape Canaveral, Fla.

Pratt pointed out that NASA's international program is the only substantial competitive space program and will be one of the main goals of the program.

• Participation on an international level in northern and communications satellite programs. Twenty nations, including Czechoslovakia and Poland, have accepted assistance to use international meteorological satellites to be held here next month. Britain, France, Canada and at least one South American country will build ground stations for the communications system.

• Standing rocket agreements between the U.S. and Argentina, Pakistan, New Republic, etc.

Although such studies U.S. satellites, a British Scout rocket was launched last September by an Australian crew from the Woomera Range, carrying U.S. instruments designed to monitor weather and climate data.

• Training programs, in which major associations are sponsored by NASA through the National Academy of Sciences, technicians trained in U.S. research centers and laboratories and general training for foreign students.

Twenty-two associations are under training in U.S. universities and clubs are being made to sponsor in many as 100 foreign graduate students during the 1961 school year. NASA will participate, while the sponsoring nation will pay passage and stipends.

Pratt said approximately 40 nations are involved in NASA's international program, including 20 in operation of U.S. tracking stations, and Britain and Canada in multiple programs.

He said NASA is extremely flexible in agreements with other countries. The agency has an understanding with the



JOINT U.S.-BRITISH international atmosphere satellite, designed UK-1, is mated for launch of British International Satellite No. 1 by National Aeronautics and Space Administration's Golden Scout Plus Rocket. The satellite, weighing 128 lb, will be launched from the Atlantic Missile Range next week on a Delta vehicle into a 200-600 mi orbit. Payload instruments were developed by several British universities and Goddard integrated them into the NASA-built satellite structure.

was, and Denmark, partly Italy, Canada, Australia, France and Sweden. Negotiations are being completed with Japan, calling for the launch of two Scout-Centaur rockets, each containing U.S. and Japanese instruments. Radio Research Laboratories is sponsoring the U.S. and Argentina, Pakistan, New Republic, etc.

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U.S. State Department allowing technical discussions before diplomatic discussions are begun. Once the technical basis has been established, he said, an agreement can be made. The first UK-1 satellite program is the result of a formal bilateral Canadian satellite program came in the result of an exchange of letters.

## Huge Waste Reported In Electronic Products

Washington—Poor management of Federal electronic research programs over the past year cost \$200 million more in unnecessary projects, according to a Senate Government Operations Subcommittee subcommittee report.

Chairman Robert H. Frosch (D-Minn.) said the reason for the waste is such "poor management of information on tens of thousands of current projects" that research contracts by the Defense Department and National Aeronautics and Space Administration often duplicate work done or in progress.

The subcommittee recommended better coordination of information on the projects, suggesting a central data base. It also urged more control over "duplicate" programs created by the nation's research and not allow their highest and best research work.



# High-Priority Military Space Pace Urged

By Rosell Hawkes

San Francisco—Present U.S. emphasis on peaceful use of space and the assignment of secondary importance to military space, defense experts must be dissuaded, the Air Force Systems Command Science and Engineering Subcommittee was told by Taylor Gardner, consultant to the Air Force Scientific Advisory Board.

Gardner said the Defense Department should be urged to start new high priority military space programs. Many qualified people here said that since it is, or is practical, orbital use for space flight capability, but Gardner observed that perfection of the technological future have added some accuracy. He cited the prediction of Dr. Albert Einstein that fusion would allow us to be heavy that they would have to be carried by ships and the prediction of Dr. Vannevar Bush that rockets could never open a continent. The development of the Soviet of the Union launch, sub-orbital launch, hypersonic aircraft, ICBM, Sputnik, circumlunar flight, and the Yutu-1 came as a succession of surprises to many U.S. experts.

With these things in mind, Gardner said it would be a mistake to restrict military space development to limits appropriate to scientific studies.

He cited "in the growth of military, commercial and civil space launch as an accident to products of military developments. It is frightening that in the total field of space power the military may lose, with military space development, as evidenced by product of scientific space experiments.

Individuals and as a nation working through its bureaucracy, it is clear that we have not been as quick as we might have been in forecasting the future. It is also clear that in the space field our men and informed technical situation are available to us that we need not postpone our action of understanding.

## Soviet Atomic Subs

Moscow—Soviet Atomic Sub launching nuclear-powered submarines "which develop a speed not inferior but superior to that of the American ones, and is no less quiet," Admiral Gorbunov wrote in the official military publication Red Star. The U.S. now has 20 nuclear-powered submarines in commission and will have another by the end of this year. This is believed to be the first time that Russia has claimed to have something like the number of nuclear-powered subs that the U.S. has.

the possibilities of the future. He said in addition to starting new space programs for defense, Gardner said the Air Force should speed up existing ones and should sharply increase studies, particularly in NASA programs and in limited activities. Those programs that were emphasize scientific experiments should be changed to assure that results will have the widest scientific usefulness.

Gardner said, "Your government must assure that our security needs in space power are accorded a more substantial status in the present programing and basic planning of our space work." The long dormant and now re-activated Space Council is the logical place to deal with this critical problem. The Space Council must recognize and deal with this critical security need in action that changes our new untried space far peace policies.

Gardner stressed the importance of government-sponsored study committees and pointed out that no Soviet rocket development program to which, within months, requirements has not changed. He called for "supersonic executive decisions, not divided group evaluations and not unduly fast. We need speed and there is the field."

The most pressing military need is for large booster rockets designed by Soviet. Gardner called it the central and immediate national deficiency of U.S. space power and urged a crash program to develop liquid solid and nuclear boosters. The large boosters now being developed may not be suitable for military applications. He said the thrust speed for military space booster ranges from 800,000 lb. thrust to 10 million lb. thrust.

The basic capabilities needed for military space missions include:

- Ability to orbit, intercept, counter, use, destroy, in orbit and land.
- Means of transportation between spacecraft.
- Methods of navigating and communicating in deep space.
- Standardized launch vehicles and techniques that can meet the military need for sudden and repeated launch operations.

• Ability to support prolonged flight of manned spacecraft.

Gardner said that we must be able to exercise these capabilities on a routine basis. While noting that space programs will involve scientific experiments, he said that these routine space operations should be conducted by the defense establishment.

He pointed out that military personnel have been used in the first U.S. and Soviet manned space flights. This was

the logical result of the fact that military motion operating conventional aircraft has already developed the base of experience for the selection and training of crews in the disciplines of space flight. He pointed out that the U.S. now has only a limited program to exploit this experience and urged that it be expanded.

To require more experience of the actual space environment, Gardner suggested a series of manned space experiments like the Discoverer series in which orbital workover and transfer of personnel would be performed frequently. One such experiment a month would not be an excessive schedule, he said. The matter, however, that can be identified as requirements are:

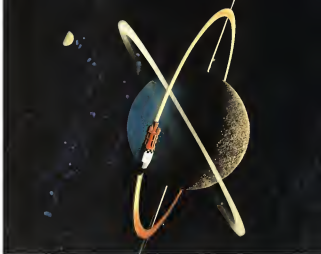
- Communications.
- Reconnaissance.
- Meteorology.
- Defense against attack from space.
- Manned space missions.

Gardner said we must improve our ability to intercept and identify hostile satellites and spacecraft and must be able to track them through space maneuvers and orbital perturbations. Also needed is the ability to intercept, destroy or destroy hostile or man-made satellites. Gardner said the U.S. must begin developing these capabilities and developing a global space defense system immediately.

## Ionosphere Reflection

New York—Technique for reflecting very high and ultra high frequencies off the ionosphere is being developed by Sperry Gyroscope Co., Great Neck, N.Y. Sperry said that the method involves utilizing the ionosphere, not as an ionized cloud within the ionosphere to produce maximum energy into the plasma. The energy would be directed to the clouds, focused separately, rather by ionosphere entering critical atmosphere as by "ionizing" elements covered by to reflect radio waves and create an ionized region about 100 miles diameter for several hours. Conducted in the technique is the pumping station, which the equipment and consisted of "two microwave beams"—penetrating two different frequencies—resulting over a single medium. This device the company said, was presently being withheld for proprietary reasons.

Sperry engineers said that the first step could take the communications band capacity by 100 times. From the high frequency to the 200-mc region. It would allow telephone and television from anywhere over distances of 1,000 mi to 10,000 mi, the company said.



Bell-powered Agnos satellite in orbit—orbital.

## THE ENGINE WITH THE FUTURE

Reliability... Efficiency... Thrustability.

In space, these words have a million-dollar meaning.

Van term of money and vital scientific data ride on these built-in attributes of Bell Aerospace's rocket engine for Lockheed's Agnos satellite, second stage of the Air Force Discoverer series.

The Agnos engine, designed with space in mind long before space became a household word, has fulfilled its every mission and has placed more tons of useful payload into orbit than any other power plant in operational reliability is backed by six years of development and 5,000 test firings.

This Bell engine now has re-usable capability—the first in the nation. This means that its engine can change orbit in space without the penalty of extra engines. Presently in production, this engine also is adaptable to new tasks and new assignments and, consequently, is programmed for important military and peaceful space missions of the future.

Agnos's engine is typical of the ongoing projects in Bell's rocket propulsion center. It is part of the dynamic new approach of a company that's forging ahead in rocketry, aviation and space techniques. These skills serve all government agencies. Engineers and scientists are now for a new kind of personal challenge can find it at Bell.



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## Airlines Split on Foreign Carrier Curbs

**Proposed legislation to control capacity and rates creates division over extent of government's role.**

By L. D. Dely

Washington—Drive by U. S. international airlines for legislation that would curb capacity and control rates of foreign flag competitors has been slowed by an ad-hoc split over the provisions of such legislation.

Chief difference is over how far individual U. S. carriers want the federal government to go in establishing the controls necessary to restrict capacity of foreign flag carriers serving U. S. gateways and to set rate maximums. Specifically, it is a breach between airlines that favor a complete freedom-of-the-market philosophy and those that support a policy of moderate government protective regulation.

Proposed legislation has been drafted by the industry. Plans were to submit the draft to the White House before the next session of Congress at the end of strong Administration bids, but it now appears that plans have been all but scuttled by carriers who feel that the legislation would only tighten government control over the industry.

Capacity and rates are understandably the two-pronged sword of battle in the current struggle between U. S. and foreign airlines. In a continuing loss of market between the Civil Aeronautics Board and representatives of six airlines—Boeing, Northwest, Pan American,

Continental, Eastern and TWA—these two elements were the most frequently emphasized in the discussions on international transportation problems.

### Amendment Proposed

It was generally assumed from the summary legislation during the meeting that new legislation could be drafted that industry would support in the case of capacity, it was decided to propose an amendment to Section 407 of the Federal Aviation Act that would require foreign flag carriers to file with the CAB all schedules of flights operating between the U. S. and points beyond

CAB is currently conducting an investigation to determine whether it should require foreign flag carriers to submit only single schedules but traffic agreements.

Under the proposed legislation foreign flag carriers would be required to file CAB approval of all schedules to not from the U. S. before they could be effective. The Board would have its approval or disapproval on whether the schedule adversely affect the public interest of the U. S. or are in violation of any treaty, convention or agreement in force between the U. S. and the foreign nation involved.

Previous U. S. attempts to permit third world transport carriers were in violation of these government's bilateral agreements with the U. S. fully filed.

No decisions were reached and several European carriers have indicated they favor to oppose to principle the changes of legislation.

As a consequence, several U. S. airlines feel that legislation drafted to enforce the U. S. position on international civil aviation will merely result in retaliation from other governments. As it is, several countries outside of Europe have imposed capacity restrictions against the U. S. to protect their flag carrier. Although the U. S. has lodged formal complaints with these countries on grounds that such restrictions violate the bilateral agreements with the U. S. American flag carriers, meanwhile, have been forced to lose to these countries.

### Rate Control Feasible

Several airlines have concluded that this may be the time to review the long-standing industry practice against CAB control of rates. To prohibit carriers who are currently opposed to any form of additional control, it was proposed that the new legislation empower the Board to implement the rates of foreign flag carriers at U. S. carriers, but permit it no authority in the international rates.

Specifically, the proposed draft would empower the Board to suspend rates of any carrier serving the U. S. if a period as long as one year, whether it is a period of existing tariff, if such rates appear to be against the public interest.

It is not surprising that this draft has met stiff opposition in some quarters. The industry naturally has fought any move made in the past to give the Board such power and, although a few carriers may have shifted their stands because of uncontrollable price-cutting

by some foreign carriers, industry-wide support of the proposal is not there.

In its testimony before the Senate Subcommittee on Aviation (AW Oct. 2 p. 77), CAB Chairman Allen S. Boyd said that the Board has not considered the Federal Aviation Act of 1958 in empowering it to fix rates in foreign air transportation. International rates now are determined by the Traffic Conference of the International Air Transport Association, subject to government approval.

Under most bilateral agreements signed by the U. S. a government that is dissatisfied with a proposed rate can protest that rate then being effective.

### Board, State Views

But because the Board is not permitted to fix rates the U. S. is unable to prevent a rate proposed by a foreign government from becoming effective if consultation with that government results in an agreement, Board said.

For some time, the Board has sought additional new powers to handle air transportation but to date has been unsuccessful in getting them," Board said.

The Board is now considering the legal and policy aspects of instituting a tariff-making body to coordinate foreign carrier policies to ensure that the Board to suspend the effectiveness of a foreign carrier's proposed rate if it appears it would be inequitable to suspend capacity conditions or restrictive a distinctive competitive practice.

Edward M. Martin, assistant secretary of state for economic affairs and to the Senate hearings that a new statute for international civil aviation has been developed in a move to strengthen the U. S. position with respect to international rates. Martin added, however, that the new statute falls short of the power needed to protect the U. S. position in international rates and to accomplish State Department's strong stand for legislation that would give the Board scheduling power in the international field.

### Senate Action

With both the Board and the State Department agreeing their demands for this new authority, a new approach seems possible that the Senate subcommittee, headed by Sen. A. S. Mike Mansfield (D-Mont.) will introduce a bill during the next session of Congress, following further hearings on international civil aviation. The bill would give the Board the rate power it wants.

At the same time, it appears highly probable that the U. S. will enforce capacity restrictions on foreign carriers through unilateral action because of international policy considerations.

## Airline Presidents Clash with CAB On Unprofitable Promotional Flights

By Robert H. Cook

Washington—Airline presidents are deeply concerned over the results of promotional flights designed to attract a new wave of passengers for the airline. Some are warning that the Board should not abandon the controversial cash plan.

Six of the 15 presidents who recently attended a closed door discussion of industry problems with the Civil Aeronautics Board said Airlines Warn the complex of low-cost fares is a serious problem, but at the expense of severely hurting the industry's own profitable first-class segment.

The airlines' unanimous description of the cash plan as "unavoidable and disappointing" was one of the most heated comments during the meeting, as the Board's philosophical support for the cash plan was linked with the industry's criticism of the low profit level.

Airlines presidents gave a public nod of approval to CAB intentions to help solve the industry's deteriorating financial condition and recognized from the meeting that the airlines in evidenced in CAB's approval of another meeting between airline representatives and Board staff members to discuss the problem of "no-show" passengers and lost revenue. Approval of the cash plan was considered a last case in CAB since it prevented airlines from being to work a common solution without loss of individual protection.

The issue of results for Board at a joint conference with the airlines seemed to support airlines' contention that the chairman might choose the session to assist his leadership by urging the airlines to accept some of his personal solutions to industry problems. This was particularly evident in the selection of flight services for further discussion and finally spent most of the afternoon that the session should "go on" to discuss the industry's own revenue loss and to transportation.

While admitting their regret that the airline meeting was able to touch upon each item of its lengthy agenda, several airline presidents criticized CAB's attempts to revise its cash plan, as it is to be more effective. Others claimed major areas of opportunities would be left unattended, but admitted reluctance to become too deeply involved in economic discussions in the presence of competitors.

In addition, "some disorientation" was admitted by some presidents who had hoped the CAB might produce concrete action on competition, which is now expected to be a major issue. Some were warning that the Board should not abandon the controversial cash plan.

A majority of the presidents endorsed the general philosophy of the Board's new approach to the industry's problems, but said they were willing to attend further conferences.

Board's report of the industry conference did not dwell on the passenger service, promotional fares and domestic and international competition. The subject of cargo was deferred from the agenda at the last meeting, because the airlines had not been invited, he said. The chairman indicated that CAB now desires this matter with cargo service in the future.

Board stipulated "no-shows" in one of the reports of the industry, accounting for 11% of the tickets sold on domestic flights and 9% on international flights.

A solution would be "concentrated action" on the problem, he said. But attempts to impose a \$10 fine did not help, since most "no-show" account holders' "apology" apparently considered the penalty negligible. The chairman declined to impose a fine, but he said he would use it as a deterrent unless airlines might accept a special insurance for which would be refunded when the passenger boarded the airplane.

As indicated in an air show yesterday, Board and CAB would support airline agreement to pin a set penalty whenever available and there is no-show. He said that the airlines had agreed to accept the penalty, but he said he would use it as a deterrent unless airlines might accept a special insurance for which would be refunded when the passenger boarded the airplane.

Board chairman would acknowledge the remarks of any individual airline president and reported that what he considered a "general consensus" of the carriers. However, he underscored much of his report with "personal opinion" which he noted as pertinent to the industry condition.

Airline load and beverage "drift" came under fire from Board, who said it was "difficult to appreciate the need of the carriers" to serve food on all flights. This is particularly true he pointed out, where airlines serve first-class meals to both coach and first-class passengers, although first-class is a much higher profit in first-class service.

## Chalk Buys Into Caribbean; BWIA-BOAC Meet

Transportation Corp. of America, headed by New York President D. Roy Chalk, is working to increase in Caribbean air transport at the time that British Overseas Airways Corp. is working to increase the sale of its wholly owned subsidiary in the area.

The U. S. company is acquiring 10-15% of the common stock of 15,000 shares of Caribbean-Gulf Airways, Inc. (AW page 18, p. 41)—which is a subsidiary of British Overseas Airways Corp. (BOAC).

Chalk is the largest private shareholder in Caribbean-Gulf Airways, Inc. (CGA), a subsidiary of British Overseas Airways Corp. that is now a wholly owned subsidiary of British Overseas Airways Corp.

Though not directly related, both the BOAC-BWIA links in Trinidad and the Caribbean airline schedule changes are in line for Caribbean air transport. Outside for a better airline, presumably both under BWIA, for the United West Indies Federation, which has been noted for its work in the Caribbean, leaving it itself of a strong and viable island state. Issues had shown progress for designing BOAC in the future between (AW page 12, p. 47).

BOAC is looking about \$2.5 million for 51% of BWIA's stock.

Transportation Corp. of America, Trans Caribbean Airways, operates scheduled passenger service between New York and Puerto Rico with connections to Caribbean in the Virgin Islands and its beginning to build traffic and other Caribbean ports served by Caribbean. Trans Caribbean will operate service with Indian Ocean (D.C. is Puerto Rico line, 12).

Chalk has 94,514 shares of stock outstanding, 12,121 of it owned by the "big five" airlines: American, Eastern, Northwest, who has interests in the Virgin Islands and Eastern had for a national peak here, who owns its interest in Caribbean







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**FIRST FIFER AFACRE** received by Ethiopia is imported by school officials and the Duke of Edinburgh. Aircraft has been modified to have fuel tanks on pylons and three mounted propellers. Below, a cockpit from a Choptank base trainer at Shekelle's gun field.



consumed. Fields will be used for the wilderness training.

College parties also include a VOR and weather beacon unit, plus a high-level transceiver for the trainees' emergency needs. Cadets will be allowed to sleep either in hostels or in their own tents; the entire program is directed at its close simulation of the air force pilot's needs in practice. For example, cadets get only a touch of combat training in the Choptank and that is such to teach them recovery from several mistakes. With aid.

The flight program will be intensive, up to 16 hr per month for each student. It is backed up by a computerized ground school which also includes a course in liberal arts because the college expects that its graduates will be "ambassadors" for Great Britain.

The college itself is the former Air Training Services Facility, purchased by the Ministry and the half from British Embassy. Ministry has al-

located about \$530,000 for college expenses in 1981 and 1982, which includes a grant of about \$100,000 toward student training, with the remainder of a total training cost per student of about \$10,000 borne by the two state-owned airlines. Each student pays a fee of \$1,100, although this sum usually is repaid through scholarship awards.

Upon reporting to their parents' station, the student is checked out as first officer, but under present plans may spend more than a year serving in a field post, negative or combative of both. British regulations call for a minimum of 200 extra hours as a navigator before a certificate is awarded and after this period, the new officer would be required to serve in the field post. He can expect to make \$2,500 per year after graduation. First-class airline options now cost about \$14,000 per year, and return about half that again as pension upon their retirement.

## BOAC Sees Loss From Strike, Traffic Slump

London-Bathth Ocean Airways Corp's appeal against allowing Coastal Eagle Airways to operate on the North Atlantic ended with the BOAC protesting heavy losses for this financial year.

The airline already has incurred a \$60-million loss due to the strike of maintenance men at London Airport (AW July 24 p. 43) according to Sir Basil Southgate, managing director. He also charged the airline has lost \$5.8 million on the North Atlantic this summer due to a slump in traffic which was put by BOAC at 11% (AW Oct. 2 p. 42).

BOAC has announced plans to cut seat capacity about 7% next spring on its routes between New York, Washington, Boston and the U.K.

In summer, Coastal Eagle started flight two British airlines operate additional traffic, possibly through the independent airline's base at Gatwick. Southgate also notes. Referring to its financial accounts, Coastal Eagle in the appeal had "After a Winterland" overruns in that the Air Trans port Licensing Board had conferred with Minister of Aviation Peter Thorneycroft on the bilateral before passing permission to fly the route in parallel with BOAC.

## Subsidy Cut Ordered For Central Airlines

Washington-Central Airlines' subsidy would be reduced about \$500,000 annually under a short-term order issued by the Civil Aeronautics Board.

Calculation of the airline's transportation rate payments under the new close and rate formula resulted in a subsidy, improvement of nearly \$100,000 during a recent four-month period, the CAB said. Operating results of the airline between Nov. 14 and Jan. 31 indicated that Central should be provided annual subsidy payments totaling \$4,809,549 in the revenue period ending Nov. 17, 1982, the Board said.

The audit concluded that Central's present subsidy is higher than amounts because the airline has experienced lower costs and higher revenues than anticipated under expanded operations which include the airline's use of equipment awarded in the Kansas Oklahoma Local Service Case.

As applied to Central, the new rate will cover only the airline's barebones need and interest expense. A final rate, when determined, will also provide Central with a return on its investment and provide for taxes. The Board noted that the short-term order is designed to prevent future overpayments.

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## Braniff Losses Bring Request for Subsidy

Washington—Braniff Airways has asked Civil Aeronautics Board to approve a \$5.5 million annual subsidy for its Latin American operations—exclusive of its Mexican route—after mounting losses for each year since it stopped increasing subsidy in 1957.

Braniff's application underscores the plight of U.S. Latin American carriers. Two Pan American Airlines and TWA Airways already have applications for subsidy pending before the Board. Pan Am, which lost \$5.1 million on its Latin American operations during 1960, has a subsidy application before the Board for operations from Oct. 1, 1956 through October 1961. Plans were made for operations from Oct. 1, 1959 through the present.

Prospects appear dim for quick Board action on Braniff's request, but any action taken is bound to indicate future Board policy toward U.S. international carriers suffering from foreign competition.

Braniff said that in 1957, when it went on a temporary non-subsidy test run, continued domestic and international revenues showed promise of its new subsidy-free operations. However, both revenues declined and the airline said that it does not expect domestic profits sufficient to offset its international losses.

Decline in Latin American revenues was blamed chiefly on increasing foreign competition—33 carriers in the Latin American market this year—and certain regional airlines. Braniff's traffic to and from Buenos Aires is said just to equate losses to the Argentine government, while exchange rates have allowed foreign carriers to offer price reductions which U.S. carriers cannot match.

U.S. Latin American carriers are currently involved in a South American route prefunding ordered by CAB (AVR Aug. 16, p. 47) that will divide which one of the carriers has, during the market will be allowed to continue to do so. CAB hopes that the remaining carriers can operate without subsidy, by eliminating duplicate routes and achieving a competitive balance.

Braniff, based on subsidy needs on losses incurred by its Latin American operations during the 12 months ended last June 30, losses for that period was over \$1.1 million before taxes. Prefunding this August 1961, Braniff figures it needs \$5.1 million subsidy, or 91.1 cents per plane mile based on 5,544,000 enroute plane miles flown during 1960.

The subsidy would be in addition to the \$350,000 enroute Latin American aid plan that Braniff receives.

## SAS, Swissair Seek New 990 Contracts

Zurich-New contracts for delivery and subsequent modification to the new Conquest 990 jet transports are under discussion and Swissair Airlines Systems are scheduled to be negotiated sometime before the end of the year. Swissair is a representative of the manufacturer and the two European carriers. Initial services may get under way late this week.

Substance of the contracts is expected to closely follow the lines of the revised part recently negotiated between American Airlines and Convair (see p. 46). Negotiations were speeded when it was found that the initial aircraft would be to meet their guaranteed speed target (AVR Sept. 15, p. 46). Carriers are completing additional studies to boost the planes present cruising speed of approximately 565 mph to 620 mph.

A British spokesman said last week that his airline wants changes in the original 990 contract that will "take into consideration" the modifications and the fact that the first aircraft will not meet their design goals.

Swissair, which at one time had hoped to receive its 990s en route to place them on its first scheduled service by the middle of November, a second in December, and again scheduled service by the end of January. The fourth aircraft will be delivered with the modifications already announced, and the first three will then be returned to Convair San Diego on a permanent basis for the American fleet.

The 990s based in the Swiss carrier have Convair to help meet the jet program time as its first Eastern service pending the arrival of the 990s as dated to be returned at least until the end of March.

On the new 990s on order by Swissair, two will be leased to SAS, which also is purchasing another two directly from Convair.

## Air Union Nations' Agreement Advances

Four European nations involved in the proposed Air Union—France, Belgium, Irish and West Germany—are studying proposals whereby the governments themselves hold membership in the Union and designate their national carriers for participation.

Previously, the carriers would be free to select any that would suit the joint corporation but currently, Air France, Sabena, Alitalia and Lufthansa (KLM dropped the Air Union plan in May, 1960, over disagreement on equity aspects).

Although the law current agreed last year to a French jet for the Union (AVR June 5, p. 47) further action has been stalled waiting for substantial government study and approval. Final signature of the governments concerned—which would permit Air Union to begin operating—has not expected before next spring. No absence of West German government protests at holding up further Air Union talks.

## France's TAL, UAT To Merge Operations

Paris—Two of France's private airlines have agreed to merge their operations to bring about the problem of jet flight. The carrier involved on Union Aero maritime de Transport (UAT) and Transports Aériens Intercontinentaux (TAI). It is expected that completion of the merger will take two years. During much of this transitional period

both carriers will continue to operate under their individual charters.

UAT served 234,000 passengers and 2,500 metric tons of freight last year. Its network extends mainly from Paris to Johannesburg with stops in southern France, northern and western Africa. TAI carried 60,000 passengers and 13,555 tons of freight in 1960. Its main route—one of the world's longest—runs from Paris through the Middle and Far East, Australia, Tahiti, Honolulu and thence to Los Angeles in ten hours.

While a complete merger is expected to take two years, TAI immediately will double its capital and absorb the bulk of UAT's capital.

## Firm Seeks Extensive Helicopter Authority

Washington—Elmer Corp. Solicitor, a Massachusetts firm, has asked Civil Aeronautics Board for authority to operate scheduled non-scheduled passenger property and mail service with helicopters in areas north of the city.

The carrier also has asked for authority, to operate between districts in areas of New England states and air ports within a 50-mile radius.

Elmer Corp. has a fleet of four Douglas Aircraft Corp. Model B5-C11 helicopters and is expected to be delivered during this month, November and December. The firm says it has a training order to acquire five new Boeing Vertol 44B helicopters from Boeing after New York Airlines drops them in on Vertol 44B. Elmer Corp. says it expects to have 15 helicopters in full 1962.



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## AIRLINE OBSERVER

►Wall Street is speculating on the merits of a **Boeing-Northeast** merger which reportedly has been discussed between the two parties.

►Agreement between **American Airlines** and **General Dynamics** for delivery of 15 **DC-9s** 990 turbojet transports (AW Sept. 25, p. 33) calls for American to lease the unmodified aircraft with the option, in effect, of returning them in February, 1981, if not satisfied with the firm. American has numerous other alternatives—limited to some degree by acquisition dates—including purchase, presumably at more favorable terms than originally called for. Progress payments for the airplanes are being booked under American's contract and will not be turned over to General Dynamics unless terms of the agreement are met.

►Hagler-Tud Co. still intends to purchase the 11 **Boeing 980s** it has on order, sources close to the project believe. Hagler reportedly had a good legal opinion to drop the suit, but has shown no indication of doing so despite TWA's decision to buy Boeing 737s rather than the Hagler 980s.

►Watch for the White House to make public a letter from Sen. A. S. Mike Mansueti (D-Calif.), chairman of the Senate's aviation subcommittee. Group President Kennedy to assign a presidential board to investigate the 16-month-old Southern Airways pilot strike. West without one **Eastern**, Sen. Mansueti's request was endorsed by at least one other Senator representing a state served by the airline. Appointment of a presidential board to probe the Southern deadlock has been a major goal of **Air Line Pilots Ass.** (AW Feb. 17, p. 49).

►Airlines have been asked by the Kennedy Administration to submit views on whether the U.S. should withdraw from or seek to modify the Warsaw Convention of 1929 which limits liability for damage in international air accidents to \$5,000 for each passenger. Airlines favor and bar association has received similar requests. Feeling it growing that liability ceiling should be raised or removed altogether. Opinions are due to be filed with the State Department before Nov. 15.

►Air traffic controllers last week were viewing with suspicion the retirement wishes of the Federal Aviation Service bill now before Congress (AW Oct. 2, p. 41). Draft legislative submitted by Federal Aviation Agency states that only with the consent of the FAA Administrator may controllers with 20 years of service retire at age 55, but that the Administrator could retire such employees involuntarily if he chose to do so in the interest of the FAA or the Agency. Air Traffic Control Ass., however, has not specifically objected to this section of the bill.

►Civil Aeronautics Board has decided to continue its requirement that airlines file monthly reports covering on-time performance of schedule operations. Reports will be confined to performance between each of the 100 top-ranking status ports, excluding those less than 200 mi. apart. High-cost carriers, all-cargo airlines, supplemental air carriers and intra-Alaska services are exempted.

►Flag carriers in Central America are considering the formation of an airline confederate in order to cut costs and increase revenues. Under the plan, airlines of the five Central American nations would integrate to create a single pooling operation.

►Federal Aviation Agency has set a deadline of Oct. 15 for public airport operators to submit requests for federal aid. Under the Federal Airport Act, FAA is authorized to allocate up to \$75 million for airport aid during Fiscal 1982.

►Texas World Airlines has been granted a 190-hr. overhaul time extension to 1,900 hr. on the Pratt & Whitney JT-4 turbojet engines which power its Boeing 737 intercontinental transports.

## SHORTLINES

►Aerolineas Internacionales transportation operating from a DC-6 arriving over central Indiana are transmitting instructions to route their own military aircrafts in a satellite way on the Midwest, as part of a series of educational programs that will run until late May 1981. The programs are sponsored by Ford Foundation and private industry. The TV equipment is installed by Westinghouse, and transmitters are from Texas.

►American Airlines will begin a 10-day morning flight, Boeing 737 flight from New York to San Francisco on Oct. 29. Flight will leave Midland 11:10 p.m. and arrive San Francisco 2:10 a.m. (local time) every day except Saturday. Meals will be patterned after New York's "21 Club."

►Boschert corporation proposal allowing foreign airlines to conduct off-site passenger charter (AW May 8, p. 59) subject to certain limitations, will go into a final review. Civil Aeronautics Board has accepted petition by U.S. and foreign airlines to discuss or suspend the proceeding.

►Boeing Airlines credit cards — for domestic flights only — are now available to commercial offices in the U.S. and focus focus without small credit checks.

►Eastern Air Lines reports independent research shows that the average executive travels 10,000 miles a year on about 19 trips that last less than one hour and office for 34 days.

►First of three Armstrong Whitworth Argosy 600 turboprop airliners ordered by British European Airways made its initial flight last month. The aircraft will be placed into BEA's cargo operations in November with the other two scheduled for delivery in February.

►Israel and France have concluded talks expected to lead to increased activities of El Al and Air France between the two countries. El Al now operates six flights to Paris weekly and Air France operates six flights to Lodz, Israel.

►Sabena will begin service to Rome and Istanbul, Turkey with Caravelle VI aircraft on Nov. 1.

►Showdown on American Airlines' flights have been restricted to provide passengers with World Series and college football scores in the time of departure and destination.

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**ARTIST'S CONCEPTION** of Lockheed C-141 shows fan request: landing gear bulges out high, except Tail. Aircraft is expected to make its first flight in November or early December, 1961 after scheduled August, 1960 rollout.

## Flow of C-141 Subcontracting Under Way

By David H. Hoffmann

Marion, Ga.—Development of Lockheed's C-141, the turboprop engine designed to bolster U.S. strategic airlift, is on schedule here as subcontract activity with more than 3,000 sub-let begin to flow toward U.S.-and foreign Civilian-manufacturers.

Only a letter contract from Air Force ordering for C141s for development testing has been received by Lockheed thus far. But the company has been told to buy its pricing policies on the purchase of 112 aircraft at each with for about \$4 million is expected. Lockheed will create the distribution of

about 51 billion in U.S. funds, all not earmarked for welfare, health

Regardless of how many C-119s it builds, Lockheed has guaranteed to sub-contract at least 51% of the entire Air Force order, and this figure excludes the aircraft engine—Pratt & Whitney TF30-P7 (TF30-DA) turboshaft. To illustrate the rest of sub-contracting

in the project. The CHIVs' complete carpenterage, joists, soffits, flange systems, sheetrock, wall framing and blocking, clips, dips, soffits, truss floor, wing-box beams and many trusses all will be done out by Lockhead.

Charles S. Warner, Lockhead Corp.

gu Dawson vice president and overall C-141 project manager, told Aviation Week that the subcontracting will extend through the coming year. Deal has for signing the last subcontract, which covers the transport and will offer awards in November, 1982.

Meanwhile, Air Force Services Canada, through its Services Program Office (SPLO), is monitoring and approving Lockheed's selection of each subcontractor. Apparently for political reasons Lockheed's has been told to consider Canadian sources of supply in contracts for C-140 components.

The C-141's engines are fixed in left stacks which define the entire line.



**PHYSICAL MOCKUP** for C-141 project shows state-of-the-art design concept. Folds down at run open, inward to allow rapid loading and unloading. Mockup is full scale. Basic dimensions have been decided, but many of the subelements still are made in early design stages.



**PLASTER TRUCK** demonstrates cargo backup to wooden mockup of C-141 at Lockheed's Georgia Division plant. Along the length of the cargo compartment are five booms that assist in forming a tangle of cables system for moving containers forward. Commercial version of the aircraft will have a lightweight cargo floor and a Lockheed-developed loading system for an empty weight saving of 1,315 lb. Petal doors of the C-141 open outward for loading on the ground or for para-dropping from an aircraft in flight.

of the C-141. Although subcontractors must work within these outer contracts in many instances they will be afforded wide latitude in designing systems and components. Subcontractors for the aircraft's engine, nose and main landing gear fall in this category, as do others.

Full price of the C-441 project is set forth in the tractable Lockheed is ready to meet. This calls for the first of the swept-wing transports to roll out in August, 1983—or less than 20

months after Lockwood received word it had been selected as group C-14 contractor.

First flight of the Lockheed C-141 to follow in November or early December, 1965.

If the first squadron of new C-141 goes Military Air Transport Service fleet in June, 1965, as planned, each can be assigned to three major factors: the full field support supplied by Department of Defense and Congress; Lockheed's own maintenance of

Georgia computer to reflect the printer's high priority and the simple, state-of-the-art design that characterizes the G-441.

The C-141 emerged from Specific Operational Requirement 182, which was issued in final form on Aug. 15, 1960. To finance the SOR-182 design competition and to get the C-141 project offing, \$70 million was included in the Fiscal 1961 budget. This amount was more than tripled in Fiscal 1962 when Congress voted \$220 million for



**TRAILER CARGO DOORS** on the C-140 are hinged horizontally. Lower sections automatically retract as upper sections swing out to expose a cross-section of the freighter's cargo compartment. The door system is hydraulically operated. Forward of the pivot doors is a pressure bulkhead shown lowered to form a truckbed-height loading ramp. It can be secured for drive-up ramp. Bare framework of C-140 cargo door assembly as left fitted on its side at Lockheed Georgia plant at night. Work is continuing on various kits.

# BENDIX COUNTDOWN FOR SPACE

7

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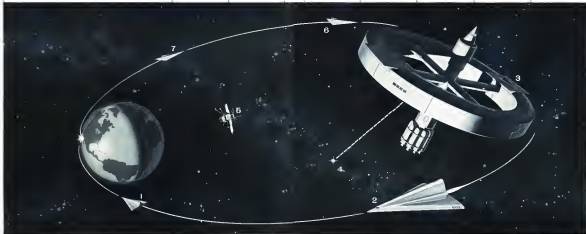
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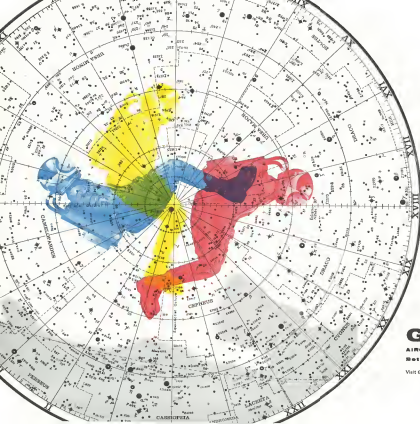
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## Lockheed C-141 History and Timetable

|   |               |
|---|---------------|
| <b>Specific operational requirement</b> | May 4, 1960   |
| <b>Development plan</b>                 | Aug. 15, 1960 |
| <b>First development flight</b>         | Nov. 22, 1960 |
| <b>First flight</b>                     | Dec. 16, 1961 |
| <b>First operational flight</b>         | Apr. 7, 1964  |
| <b>First delivery</b>                   | Apr. 16, 1965 |
| <b>First flight</b>                     | May 1965      |
| <b>First flight</b>                     | Nov. 1965     |
| <b>First flight</b>                     | Dec. 1965     |
| <b>First flight</b>                     | Jan. 1966     |

structure of the C-141 is its to support or replace existing aircraft at all air stations without elaborate support equipment. Located under the freighter's cargo floor, the main gear and the nose gear will fall free and lock, assisted by hydraulic pressure. • Short field capability without substantial high lift devices. Technicians believe that the C-141 could leave Denver for New York with a full payload and arrive fast on a 100 deg. day, even though Denver is 5,200 ft above sea level. Under military conditions, the aircraft can land on a 5,500 ft strip at its maximum landing weight.

Flexibility of the C-141, in that it can land or deep traps or heavy equipment into a combat zone, equipped with its cargo and speed, undoubtedly will give the base a value the U. S. to meet militarily to global crises. During last spring's Operation Softshell, in Panama, for example, Tactical Air Command C-141s from Westpointe Army Corps parachute, coming from bases in the southeastern U.S. to Central American drop zones.

After roughly a four flight, STRAC troops landed their supplies in the air, then mounted a successful "transfer" jump. This technique, if necessary, could be employed with the C-141, but

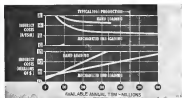
over for greater distance. Paratroops would suffer less flight fatigue with the lower noise and vibration levels inside the transport.

Consequently, a MATS spokesman told Aviation Week, the main plan is to complete in phase of 1966, "interceptor" Douglas C-119s and C-119s and the remaining Lockheed C-119s when the C-141 becomes available. As a result, MATS' aircraft on duty to foreign refueling bases will be reduced.

Such strong growth would seem to guarantee the new transport a successful military future. But whether U. S. airlines will accept the L-100, commercial counterpart of the C-141, will be an open question.

Industry admits, privately, that it is easier to persuade a commercial transporter that will not be used for the same reason. Nevertheless, several airlines have not been for sale and others have entered on these contracts.

Department of Defense and Federal Aviation Agency hold from the outset to give airline manufacturers sufficient weight in defining SOA-102, the L-100 bids the flexibility to meet the unique needs of various with contrasting rate structures, the L-100's ability to open



FOR CURVE plots the relationship between L-100 aircraft costs in units per two dollar rate (CPI) and annual's ability to produce TSMs of cargo. Bottom curve plots these costs in millions of dollars. Note the effect of increased load hauling on both. Presentation is based upon Lockheed analysis of two typical domestic and two typical international routes likely to be flown by the L-100.





# L<sup>2</sup>

Air Products pioneered in the application as well as the production of liquid hydrogen ... the ultimate fuel ... for missiles and rockets. Examples: the test facilities for Nike, and test facilities for even newer missiles. Air Products possesses missile propellant system capabilities for others can match. If you have a problem in propellant systems, look to Air Products first for the answer.



## Engine Tests Under Way

Ford & Whaley reports that its CF35-F7 (JT3D-8A) turbojet engine powerplant selected for the Lockheed C-141, now is undergoing full-scale tests including thrust output and endurance tests.

Endurance power assessments will take the engine to 81,000 horsepower on both thrust (15,000 lb.) and specific fuel consumption, according to F&W. The goal is scheduled for military qualification tests in January, 1964.

January, 1965. To ensure that this target date is met, F&W engineering test plans—along with their counterparts from Lockheed and SPO—will occupy seats in the cockpit in the C-141 engine's flight tests. Such three-way supervision will characterize the C-141 program as it unfolds.

Nevertheless, it is possible that even if commercial engines enter early, service with the L-100 cannot be interrupted until sometime in 1966. In place, Lockheed stresses the volume of cargo moving on international and domestic air routes will have climbed to the point that makes a 75,000 lb. payload feasible a possible requirement.

Lockheed also feels that while on base are awaiting the new transport, various freighters such as the Convair CL-44, Douglas DC-7C and Lockheed 1049H will develop markets that the L-100 can never fully replace. At the same time, improved techniques of packaging and handling airfreight will boost the peak payload potential of the L-100's quick turnaround capability.

Final location of the outside air Lockheed believes, virtually rule out both a Strategic Air Command or even a Navy jet and a comparable such as Military Air Transport Service help coming to study with needs during national emergencies. But the U. S. can count upon a self-supporting transport fleet capable to the military during crisis of commercial carriers require L-100s, the company maintains.

Answering early complaints on the absence of proper L-100 test and performance data, Vice President William Adams says that C-141 model specifications still are being negotiated with Air Force. When these have been worked out, Lockheed intends to test with interested airlines with every part of L-100 detail for their review.

When the C-141 project got under way, Lockheed's lines of commercial communication ran through SPO to FAA, to the Air Transport Association and the individual airlines. But this circuit has been shortened by Lockheed, which now, instead of deal directly with prospective airline purchasers of the L-100

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## Rolls Studies Lift-Jet Engine Applications

By Herbert J. Coleman

London—Rolls-Royce engineers are studying possible layouts of lift jet engines at forward and rear fuselage or craft and claim that two types of VTOL airplanes can be developed in the near future, using data now available or the results of current research and testing.

The airplanes, according to G. L. White, chief of propulsion design, are a ducted-ramjet wing vehicle aircraft capable of high subsonic speeds on the deck, and a transport which could have either VTOL or STOL characteristics.

One strike fighter, a new configuration would have a low aspect ratio wing and the four lift engines would be installed in two pairs at the front and rear of a central weapons bay. Propulsion would be by two pairs jets in the wing roots.

The airplane, White said, has a layout that presents no great difficulties. Proving aircraft from a cruise take-off would be easier than that required by a modified delta planform and thus would need a greater lift thrust-weight ratio.

A modified delta type explored by Rolls follows the acceleration layout of the Sud Orléans and the engine layout of the Short SC1 VTOL, which is powered by the Rolls RB108 turbojet powerplant. In this model, the airplane has four lift engines in the center fuselage and a single turbojet engine for propulsion.

Both airplanes, White mentioned, are sketched during the lower and two stage jet, control jets in the wing tips and fuselage, but he is concerned as well of the lift engines. "Three of the control jets could be supplied by an auxiliary engine."

Rolls' basic policy is reconstruction of aircraft engines, not aircraft design, but White said the studies were made to guide future planning of aircraft engines. Studies concern use of both turbojet and turbofan types.

White pointed out that it was possible to design a lift jet engine with a thrust up to 15 times its weight, that compares with the thrust-weight ratio of 3.1 for the RB108, which has gained more than 4,500 lb of thrust and lift experience.

Rolls presently is running the RB108 in extensive testing to determine the best for aircraft use. The engine, which produces 2,380 lb thrust with a 10:1 compression bleed and 1,500 lb thrust without bleed, could be developed to a 3:000 lb thrust engine with a 10:1 thrust weight ratio. However, Rolls believes it now is possible to design a lighter, cheaper and more simple



ROLLS-ROYCE RB 108 lift jet engines are displayed above in proof configuration. RB 108 has compressed more than 4,500 lb of thrust and lift experience, according to Rolls-Royce. The engine has a thrust-weight ratio of 3:1. The RB 108 lift jet engines are shown as they would be installed in vehicle (AIE Sept. 25, p. 11).



TACTICAL TRANSPORT, as envisioned by engineers at Rolls-Royce, would have 20 turbojet lift engines in wing pods. The tactical transport would have two pairs jet engines fitted with pt deflection for forward propulsion.



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engine with out put out of thrust not to less than half that of a propulsion engine at the same thrust. Engine versatility and advances in materials are the key to this concept.

In considering aircraft applications involving liftjets, Wide thinks the best approach is to design the airplane for VTOL operation from the start, noting that the substitution increases ability during vertical takeoff and landing, a thrust/weight ratio of 1.2 is necessary. For STOL performance, based on reaching 50 ft altitude in a distance of 100 ft, it is necessary to deflect thrust during takeoff at a low forward speed and Wide said airplane aerodynamic controls will not provide sufficient pitch and roll control for take-off operations.

Design parameters for an STOL airplane, he said, would call for a choice between a single engine whose propulsive thrust could be deflected for lift as a composite power source with separate propulsive and booster engines, all of which have a series of thrust deflection. Thrust/weight ratio of 1.05 is needed in both cases, according to Wide.

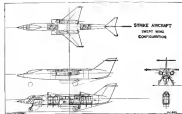
Referring to the single-engine design, Wide said the engine must be a compromise between takeoff and cruise requirements; it will have to reach thrust for takeoff and cruise and would need a medium pressure ratio to keep specific weight low, along with high bypass ratio to cut fuel consumption. It also would have poor specific fuel consumption at high takeoff speeds because the engine would be well throat choked.

The composite powerplant at zero lift, propulsive and lift engines, deflects thrust for takeoff, can be designed without the need for compromise. In addition, the engine with the most power engine will be much smaller than the single-engine aircraft powerplant of the composite low-bypass propulsive engine, producing a good specific fuel consumption.

Choosing the single-engine plane at its maximum speed of Mach 0.45 Wide said, would call for throttling to 17% of maximum thrust; the composite type would call for throttling to about 70% of the maximum rating.

Two main multiple engine layouts are possible for the VTOL strike aircraft, the engine combined. This arrangement is what the propulsion engine thrust is diverted outward to aid in the vertical thrust of the lift engines.

Previous for all lift thrust is light weight booster as lift engines, such as the Short SC-1, with no deflection of the main propulsion engine, thus eliminating need for heavy and bulky pitch deflection. This approach also avoids the design problem of placing propulsive engines so that the deflected thrust



STRIKE WING strike fighter has lift engines placed fore and aft of the weapons bay.

line passes through the airplane's center of gravity, or close to it.

With both types, Wide said, lift engine thrust can be tilted by up to 20 deg from vertical with small weight penalties and at a large horizontal thrust component can be provided to assist in acceleration or deceleration.

To estimate weight of a VTOL airplane for low level strike missions, the Navy team selected a delta platform with low aspect ratio, existing high-lift devices and assuming a lightweight landing gear. With these restrictions, a structure weight of 18.2% of takeoff weight would be possible, against 28.5% for the STOL airplane.

Turning to the tactical maneuvering field, Wide mentioned two possibilities: both involving conventional airframes except that pure lift engines or lift fans would be exposed in pods on the wings. One model would use two lift engines for propulsive, with 12 clustered lift engines, and the other 18 low lift engines plus two 15,000 lb thrust propulsive engines equipped with thrust deflection.

This type of approach would be useful in proving operational experience but the arrangement, Wide said, offers little scope for reduction of structure weight. The two-engine design is problematic in that it probably would be impractical to deflect all thrust for STOL operations, such as is possible for the smaller strike airplane. Wide claims that if the 500 ft obstacle is 10 ft high which is needed, it is best to design for VTOL operation from the beginning.

Size or number of lift engines is determined by matching the maximum engine takeoff rating to the lowest available equivalent conditions likely to be met. At maximum rating, a lift engine would have an exhaust life of about 200 hr. However, the Short

SC-1 takes 30 sec. from takeoff to forward flight and Wide said it is unlikely that lift engines in future aircraft will run at full power for considerably less than 1 min, as over-control in an engine idling engine modes, but more possibly for 1 or 2 min.

Thus, a lift-engine could have an exhaust life of 800 hr, assuming 1 hr sorties and that only 20% of the takeoff rate at maximum design rating of 1000 and 2,000 lb, with the rest at sea level and hovering at 80% of takeoff weight.

Lift engines also must have good starting characteristics, low idling speeds, fast acceleration rates and rapid thrust response to sudden changes in fuel flow. Wide said, mentioning that most of these requirements are met by the RB108. This engine has a thrust response to maximum demand of about 0.3 sec., yielding it easy to control aircraft height by direct sensor operation of the collective lift engine throttle.

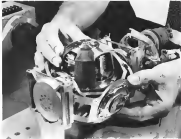
## Utility Aircraft Exports Increase in First Half

Washington—U.S. civil utility aircraft exported during the first six months of 1961 increased 25% in value and 15% in number over corresponding periods last year. Aerospace Industries Association reported.

In June 10 of the year, less of U.S. manufacturers had reported 174 utility aircraft valued at \$11,494,180. AN's report also covered aircraft weighing less than 6,000 lb. empty and excluded all transport categories.

Shipments reached 65 nations, with Argentina buying 100 aircraft valued \$1,850,100 to help the army. Next largest purchases were Canada, which bought 174 aircraft valued at \$1,786,900, and West Germany, which bought 28 aircraft valued at \$1,641,900.

Gas-lubricated bearings are another and particularly noteworthy improvement in the small (1½" by 1½"), light (under 2 pounds) gyros. These bearings use 1/10th of the clearance between bearing surfaces.



Another feature of the P-300 is the use of direct drive gunball coupling. By incorporating this type of design,

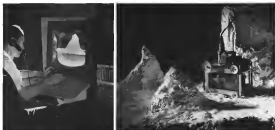
The Polaris Survival platform is the latest of more than half a dozen inertial navigation systems that have been successfully developed to the operational phase at Litteron Systems. The Litteron engineers who researched and developed these systems are always pleased to divulge additional details. Equally important, they are anxious to exchange ideas with new associates who have a sound flair for engineering of the next White, phone it drop by for a visit. Mr. Don Kraus, Litteron Systems, Inc., Guidance & Control Systems Division, 5500 Carnegie Avenue, Woodland Hills, California, Telephone (805) 494-0400.

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Roving Lunar Vehicles—Part II

## Roving Vehicle Control Poses Problems

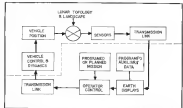
Bo. Barry Miller

At the center of these problems is an extension of the same challenge: perhaps somewhat more extreme, combining aircraft and automobile designs and operation skills. That is how to enable the vehicle operator to anticipate the posture and response of his vehicle. The amount of anticipation is a function of system parameters such as vehicle control response, vehicle speed and resolution of visual information, cognition at Airborne Instruments Laboratory, point out. Aherne, a division of Underhillman, Inc. is one of several companies that are concerned with the problem of making systems for controlling mobile robots or vehicles from remote points on the earth.

These companies are looking at proprietary control techniques, satellite-referenced, radar and television scans that

Flowing surface space vehicles past nearby lunar vehicles that might pose about the moon's surface during scientific data, providing logistic support for essential lunar exploration and moon

Initially, a major purpose of counterterrorist surface vehicles will be to perform exercises in interception of man's arrival on the moon and other



**ISS-ING LUNAR VEHICLE** Control loop includes earth-based portions—control programs and communications (above below the broken line) and vehicle elements, control and position sensors, transmission link and systems provided by terrain.



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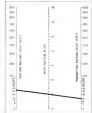
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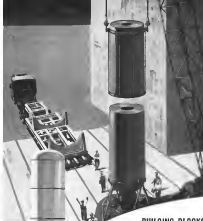
an operator has in judging and interpreting laser terrain, the vehicle might easily slip or roll into a crater and require new commands to maneuver out of it. If the local-optic transmission between it and its earthbound operator then is broken, the operator may lose and fail to regain command of it.

In its proposed lightweight moving vehicle, SpaceControl has included six emergency stops, manual and which can cause the vehicle to halt, as should the operator lose control of the vehicle. The nature of the command received in the vehicle's communications system is lost to a signal strength monitor before going to the emergency command. If signal strength drops below a predetermined level, the vehicle will halt.

• Lower surface communications—if the moving vehicle is controlled from a stationary as delivery vehicle at the base into a different set of problems may be introduced in the actual laser terrain. For example, laser terrain is greater than that of the earth, more highly restricting the distance between point-to-point communications antennas on the moon. For a 6 ft. base line of sight to the horizon is only 14 mi. Closest unit. For reasonable antenna heights (length 30 ft. in each case), line-of-sight distance may be 5 mi. The need to have miles of close intervals might add expense and complexity to the task.



CURVATURE of the moon surface makes distance to the horizon shorter than on earth, thereby easing slightly surrounding the possible-point distances between transmitter and receiving antennas of given lengths. As shown in the diagram prepared in Anderson Instruments Laboratory, straight lengths indicate that a moving vehicle, which transmits data to earth via a relay on a stationary base vehicle, would need a 10 ft. antenna at stationary vehicle receiving antenna may 34 ft. and if even were to be up to 5 mi. in the base vehicle.



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with untold time, suggesting, the  
company, explains that moving and  
additional information about the ter-  
rain will improve operators' control of  
a moving vehicle.

• **Conventional** display views can be  
reversely. The supply of collision  
risk, place with objects not in im-  
mediate field of view. The video dis-  
play did not indicate where the obstacle  
was in relation to the vehicle after it  
had passed out of the field of vision of  
the camera. Wielded caution and warn-  
ing collisions would result without the  
conventional view.

• **Proactive** information between  
operator and machine was introduced.  
• **Operator** as the unknown environ-  
ment is difficult to maintain. Opera-  
tionally would be desirable.

Determining whether to equip the ve-  
hicle to transmit data directly to the  
earth or to its parent craft for relay to  
earth will depend on a number of fac-  
tors. These would include amount of  
power available in the vehicle, its in-  
cluded parent vehicle, power required  
for transmission and the transmitting  
frequency.

If the transmitter or parent vehicle  
were a relay station which would relay  
the moving vehicles data to earth, com-  
mand center then.

• **Directional** antenna (aimed on the  
earth) would not be needed by the re-  
lay vehicle relaying it to the ground to  
supply power for antenna orientation  
equipment.

• **Transmitter** power and pressure power  
consumption can be minimized because  
the vehicle would be transmitting only  
about 5 mi to the stationary earth.  
If the action of vehicle operation were  
to extend beyond 5 mi from the parent  
craft, it is probable would be lighter  
and support incoming data center from  
the stationary vehicle because magne-  
tic in additional relays would have to  
be placed over five miles to maintain  
the parent from communication.

For communication in the other di-  
rection from the earth to the moving  
vehicle, transmitters would be directed  
in the pressure need for the earth on the  
ground, the need to maintain the parent  
responsibility of the vehicle, earth  
would not be a factor on earth.

Antenna capabilities that 1.5 watts  
would be required for direct transmis-  
sion from the direct to earth. This  
avoids operation in the 1,000 mhz  
range for ultra-NASA's Goldstone,  
CASA, Deep Space Instrumentation  
Facility, a 15-ft parabolic antenna  
located 300 mi. radio bandwidth,  
and single sideband AM modulation is  
1 per sec frame rate. Reducing frame  
rate to 1 sec halves power required.

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| SERVO    | FRAME | VOLTS | VOLTS | STALL    | SPEED | STALL | ACCEL   |
|----------|-------|-------|-------|----------|-------|-------|---------|
| MODEL    | SIZE  | #1    | #2    | TORQUE   | RPM   | FW/FL | RND/SEC |
| 20111-1  | 1     | 26    | 14    | 11.00 IN | 4200  | 1.5W  | 100.00  |
| 20111-2  | 1     | 26    | 14    | 11.00 IN | 4200  | 1.5W  | 100.00  |
| 20111-3  | 1     | 26    | 14    | 11.00 IN | 4200  | 1.5W  | 100.00  |
| 20111-4  | 1     | 26    | 14    | 11.00 IN | 4200  | 1.5W  | 100.00  |
| 20111-5  | 1     | 26    | 14    | 11.00 IN | 4200  | 1.5W  | 100.00  |
| 20111-6  | 1     | 26    | 14    | 11.00 IN | 4200  | 1.5W  | 100.00  |
| 20111-7  | 1     | 26    | 14    | 11.00 IN | 4200  | 1.5W  | 100.00  |
| 20111-8  | 1     | 26    | 14    | 11.00 IN | 4200  | 1.5W  | 100.00  |
| 20111-9  | 1     | 26    | 14    | 11.00 IN | 4200  | 1.5W  | 100.00  |
| 20111-10 | 1     | 26    | 14    | 11.00 IN | 4200  | 1.5W  | 100.00  |
| 20111-11 | 1     | 26    | 14    | 11.00 IN | 4200  | 1.5W  | 100.00  |
| 20111-12 | 1     | 26    | 14    | 11.00 IN | 4200  | 1.5W  | 100.00  |
| 20111-13 | 1     | 26    | 14    | 11.00 IN | 4200  | 1.5W  | 100.00  |
| 20111-14 | 1     | 26    | 14    | 11.00 IN | 4200  | 1.5W  | 100.00  |
| 20111-15 | 1     | 26    | 14    | 11.00 IN | 4200  | 1.5W  | 100.00  |
| 20111-16 | 1     | 26    | 14    | 11.00 IN | 4200  | 1.5W  | 100.00  |
| 20111-17 | 1     | 26    | 14    | 11.00 IN | 4200  | 1.5W  | 100.00  |
| 20111-18 | 1     | 26    | 14    | 11.00 IN | 4200  | 1.5W  | 100.00  |
| 20111-19 | 1     | 26    | 14    | 11.00 IN | 4200  | 1.5W  | 100.00  |
| 20111-20 | 1     | 26    | 14    | 11.00 IN | 4200  | 1.5W  | 100.00  |

| MOTOR    | FRAME | VOLTS | VOLTS | TACH     | STALL  | SPEED | RPM    | TOTAL | ACCEL   |
|----------|-------|-------|-------|----------|--------|-------|--------|-------|---------|
| MODEL    | SIZE  | #1    | #2    | VOLTS    | TORQUE | RPM   | RPM    | WALL  | RND/SEC |
| 20111-1  | 1     | 26    | 14    | 11.00 IN | 4200   | 1.5W  | 100.00 | 1.5W  | 100.00  |
| 20111-2  | 1     | 26    | 14    | 11.00 IN | 4200   | 1.5W  | 100.00 | 1.5W  | 100.00  |
| 20111-3  | 1     | 26    | 14    | 11.00 IN | 4200   | 1.5W  | 100.00 | 1.5W  | 100.00  |
| 20111-4  | 1     | 26    | 14    | 11.00 IN | 4200   | 1.5W  | 100.00 | 1.5W  | 100.00  |
| 20111-5  | 1     | 26    | 14    | 11.00 IN | 4200   | 1.5W  | 100.00 | 1.5W  | 100.00  |
| 20111-6  | 1     | 26    | 14    | 11.00 IN | 4200   | 1.5W  | 100.00 | 1.5W  | 100.00  |
| 20111-7  | 1     | 26    | 14    | 11.00 IN | 4200   | 1.5W  | 100.00 | 1.5W  | 100.00  |
| 20111-8  | 1     | 26    | 14    | 11.00 IN | 4200   | 1.5W  | 100.00 | 1.5W  | 100.00  |
| 20111-9  | 1     | 26    | 14    | 11.00 IN | 4200   | 1.5W  | 100.00 | 1.5W  | 100.00  |
| 20111-10 | 1     | 26    | 14    | 11.00 IN | 4200   | 1.5W  | 100.00 | 1.5W  | 100.00  |
| 20111-11 | 1     | 26    | 14    | 11.00 IN | 4200   | 1.5W  | 100.00 | 1.5W  | 100.00  |
| 20111-12 | 1     | 26    | 14    | 11.00 IN | 4200   | 1.5W  | 100.00 | 1.5W  | 100.00  |
| 20111-13 | 1     | 26    | 14    | 11.00 IN | 4200   | 1.5W  | 100.00 | 1.5W  | 100.00  |
| 20111-14 | 1     | 26    | 14    | 11.00 IN | 4200   | 1.5W  | 100.00 | 1.5W  | 100.00  |
| 20111-15 | 1     | 26    | 14    | 11.00 IN | 4200   | 1.5W  | 100.00 | 1.5W  | 100.00  |
| 20111-16 | 1     | 26    | 14    | 11.00 IN | 4200   | 1.5W  | 100.00 | 1.5W  | 100.00  |
| 20111-17 | 1     | 26    | 14    | 11.00 IN | 4200   | 1.5W  | 100.00 | 1.5W  | 100.00  |
| 20111-18 | 1     | 26    | 14    | 11.00 IN | 4200   | 1.5W  | 100.00 | 1.5W  | 100.00  |
| 20111-19 | 1     | 26    | 14    | 11.00 IN | 4200   | 1.5W  | 100.00 | 1.5W  | 100.00  |
| 20111-20 | 1     | 26    | 14    | 11.00 IN | 4200   | 1.5W  | 100.00 | 1.5W  | 100.00  |

| MOTOR    | FRAME | VOLTS | VOLTS | STALL    | SPEED | STALL | ACCEL   |
|----------|-------|-------|-------|----------|-------|-------|---------|
| MODEL    | SIZE  | #1    | #2    | TORQUE   | RPM   | FW/FL | RND/SEC |
| 20111-1  | 1     | 26    | 14    | 11.00 IN | 4200  | 1.5W  | 100.00  |
| 20111-2  | 1     | 26    | 14    | 11.00 IN | 4200  | 1.5W  | 100.00  |
| 20111-3  | 1     | 26    | 14    | 11.00 IN | 4200  | 1.5W  | 100.00  |
| 20111-4  | 1     | 26    | 14    | 11.00 IN | 4200  | 1.5W  | 100.00  |
| 20111-5  | 1     | 26    | 14    | 11.00 IN | 4200  | 1.5W  | 100.00  |
| 20111-6  | 1     | 26    | 14    | 11.00 IN | 4200  | 1.5W  | 100.00  |
| 20111-7  | 1     | 26    | 14    | 11.00 IN | 4200  | 1.5W  | 100.00  |
| 20111-8  | 1     | 26    | 14    | 11.00 IN | 4200  | 1.5W  | 100.00  |
| 20111-9  | 1     | 26    | 14    | 11.00 IN | 4200  | 1.5W  | 100.00  |
| 20111-10 | 1     | 26    | 14    | 11.00 IN | 4200  | 1.5W  | 100.00  |
| 20111-11 | 1     | 26    | 14    | 11.00 IN | 4200  | 1.5W  | 100.00  |
| 20111-12 | 1     | 26    | 14    | 11.00 IN | 4200  | 1.5W  | 100.00  |
| 20111-13 | 1     | 26    | 14    | 11.00 IN | 4200  | 1.5W  | 100.00  |
| 20111-14 | 1     | 26    | 14    | 11.00 IN | 4200  | 1.5W  | 100.00  |
| 20111-15 | 1     | 26    | 14    | 11.00 IN | 4200  | 1.5W  | 100.00  |
| 20111-16 | 1     | 26    | 14    | 11.00 IN | 4200  | 1.5W  | 100.00  |
| 20111-17 | 1     | 26    | 14    | 11.00 IN | 4200  | 1.5W  | 100.00  |
| 20111-18 | 1     | 26    | 14    | 11.00 IN | 4200  | 1.5W  | 100.00  |
| 20111-19 | 1     | 26    | 14    | 11.00 IN | 4200  | 1.5W  | 100.00  |
| 20111-20 | 1     | 26    | 14    | 11.00 IN | 4200  | 1.5W  | 100.00  |

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## AVIONICS

### Lightweight Inertial Unit Cuts Complexity

By Philip J. Khan

Grand Rapids, Mich.—Extremely simple, lightweight inertial guidance systems for tactical surface-to-air missiles which use gas-driven gyros and is expected to cost less than \$10,000 in quantity production, has been developed here in late '66.

An experimental model has been declared acceptable by the Army Ballistic Missile Agency for advanced tests and a prototype system is scheduled to deliver by the end of this year.

Based on measured drift rates of about two degrees per hour, Lear engineers calculate that the system can provide CEPs (circular error probable) suitable for medium-range surface-to-air missiles. The system is a modified, low cost, no-a-aid-inertial unit which has a near-belt-drive inductor with aerodynamic control during the terminal phase of the mission.

The system, expected to weigh as little as 10 lb., includes a three-gyral, gyro-stabilized platform, weighing 10 in. dia. x 10 in. high, containing two accelerometers, plus a separate package containing control amplifiers and integration. For an additional 4 to 10 lb., the system could be expanded to include the missile's autopilot and pitch axis programming, Lear estimates.

The simplicity of the new system stems from the use of gas-driven gyros whose angular momentum is used directly to stabilize the platform instead of the more familiar technique of using the gyros only as a spatial reference to which the platform is slaved by means of servo systems. When a static error in the Lear system changes attitude, it causes one of the gyros to precess which in turn generates torque which keeps the platform in its original spatial orientation.

This "brute-force" approach discards most of the signal pickup, torque motor, coding, modems, amplifiers and mixer of the shyness which are in vogue for the more conventional platform design, according to Robert Fink, platform project engineer.

The gyros in the experimental unit demonstrated how to Avionics West point to delivery to ARMA have an angular momentum of about 13 in. dia. gyros in use. The prototype model scheduled for delivery later this year will contain gyros with a momentum of 18 in. dia. gyros in use, despite their slightly smaller overall size.

The gyro wheel is quickly brought up to its 60,000-rpm speed using cold gas, such as helium. Normally, this would be done just prior to missile launch but being decoupled from the gas supply, the gyros will coast for about four minutes before losing half of its initial momentum.

#### Platform Design

The stabilizing platform is an inside-out three-gyral design which provides 500 deg. (unaided) freedom about the pitch axis and 10 deg. about roll and yaw axes. The pitch axis is the reference gyro, followed by yaw and roll in that order.

Each of the remaining gyros is supported in a gimbal that provides a fitting of mechanical freedom. Any spatial torque arising from imperfect gyro-balance or bearing friction will cause the appropriate gyros to precess about its individual gimbal axis in a "slouch" that spurs torque. This produces no adverse effect on system performance. Low cost, unless the gyro precesses sufficiently to hit its mechanical stop, which is not likely to occur on flights whose duration is less than two minutes, Lear says.

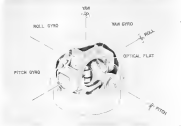
For longer duration flights, the gyro is prevented from hitting its mechanical stops by a simple technique which

effectively compensates for apparent gyrobal torque. This is done by mechanically coupling the gyros to each other back and forth through an angle of about six degrees, three degrees either side of its center position. This oscillation is at a period of about 1 to 30 sec., is produced by an a-c torque motor, one on each gimbal ring, controlled by a glassed wheel in a control system that would be present from the gyros when they are precessed about their deposit either side of center.

The advantage of this torque is considerable to gyro drift rates, spurious torques add to or subtract from those mechanically produced in the torque motor, merely moving the gyros to precess more rapidly in one direction than it does in the other.

In operation the three gyros can be seen double oscillating back and forth on the limited gimbal angle while the platform itself remains stationary.

As the gyro begins to run down after being decoupled from the cold gas supply, the decoupler itself generates torque which requires compensation by increasing the size of the gyro (pitch and yaw) so their torque loss is opposite directions about a common axis,



**LEAS SYSTEM** includes stabilized platform, which contains three single axis gyros, two accelerometers and supplies an inside-out gyrobal system. Lear estimates system model cost under \$10,000 in quantity production.



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ment, integration is reported to be performed by an electronic Miller-type feedback circuit, or an electro-mechanical integrator with less precise components than the drive-stage circuit.

### 1977 FILTER CENTER

► **New Trend: Polysynthetic Computers**—Development of new techniques for high speed data transmission over coaxial, fiberoptic, acoustic and microwave linkages is opening the way to a new concept known as the "Polysynthetic Computer." This is a collection of digital computers, which can be situated at widely separated locations, which are interconnected to operate in effect, as a single extremely high-speed computer. Thompson Research Worldwide, working under Rome Air Development Center sponsorship, is scheduled to demonstrate a polysynthetic computer in the near future. International Research Machines Corp. recently demonstrated a magnetic tape transmission unit which permits two computers to exchange data over telephone facilities at rates up to 63,500 characters per second—the maximum speed at which the majority of computers can accept data from magnetic tape.

► **Fuel Cell Has High Efficiency**—Thionin's regenerative fuel cell with conversion efficiencies exceeding 90%, has been developed by Aeronautics Research Laboratories, Chicago. The new fuel cell uses liquid anodes and cathodes, an electrolyte, and an electrode, operating through a solid electrolyte. Open circuit voltage is 0.47 v, which drops to 0.3 v under load. Development was sponsored by the Navy.

► **RCA Reports Superconducting Advances**—Mass production techniques for rapid growth of crystalline, multilayer, superconducting compounds have been developed by Radio Corporation of America. The RCA has been used to produce uniform coated coatings of niobium on fine wire at the rate of 10 ft per hr., and this figure is expected to be increased greatly with production refinements. Tests performed on coated wire by University of California Lawrence Radiation Laboratory show that it carries superconducting current in a 4,500 gauss magnetic field while supporting a current of 7 amp, equivalent to 100,000 gauss of 100,000 amp per square centimeter. RCA reports. Techniques also can be used to produce hollow tubes of crystalline niobium for the compact coils.



## Class is now in session

Last month, the first group of Air Force student pilots began active training in the supersonic Northrop T-38. In the T-38 they will learn all the skills and techniques of supersonic flight under modern combat conditions.

On completing their training schedule, they will be qualified to check out in the most advanced single or multi-engine aircraft in our inventory.

**NORTHROP T-38**



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## THE LAST SALUTE

As the American watched, the German pilot raised up in the rear cockpit of his biplane and saluted smartly. It was his last salute. A split second later an explosion ripped through the fuselage, blowing it into two pieces. With its engine full open, the front section rolled over and raced toward the banks of the Anzac Marine Canal 14,000 feet below.

It was end September, 1915, and the American in his Nieuport XI had witnessed one of the most bizarre accidents of World War I flying.

The action began at Sgt. Bert Hall of Kentucky, fighting in the air service of France, was flying inside the German lines between Rheims and Verdun. At about 14,000 feet, Hall was surprised as the German flew above him and tossed the first of several aerial hand grenades. Hall was close enough to see the German pull the fore gun of his last Pflegermann—and to observe the enemy's wild scramble as he dropped the grenade in his own cockpit. Sixty seconds later the episode ended.

Hall was flying the "Rudy" Nieuport, a biplane powered by an

80 hp, Le Rhone rotary engine in a top speed of 57 mph. at sea level. The little plane could reach its ceiling of 25,000 feet in 41 minutes, but carried fuel for only 2 hours of flying. The Nieuport XI was armed with a single, lightweight Lewis gun mounted above the cockpit section so far above the arc of the prop. The plane was first received by French units late in the summer of 1915. With the help of the D.H. 2 it helped master the famous Fokker sevenplanes.

Called the "Bibi" or the 25-meter Nieuport, the plane had a wing area of about 140 square feet—approximately the size of an airplane and some farther than the modern C-45.

Bert Hall, an almost legendary soldier of fortune, left home in his teens and worked variously as a dockhand, mechanic and auto racing driver before going to France in 1909. There he met the Germans and learned to fly their early planes, and he met Lileux, who taught him to fly a trainer plane.

Before the war he became chief and sole member of the Fulgencio air force, then switched airplanes and headed up the opposing air force of the Salles of Turkey. Hall was living it up in Paris following a hard-earned tour of Europe when World War I was declared. The next day he joined the French Foreign Legion—the only French armed service that would accept non-citizens.

Hall was a founder of the Lafayette Escadrille, a French squadron made up of American volunteers and activated in April of 1915. By war's end he had scored 26 kills.

The Hall story seems endless. In 1917 he was sent on a mission to Russia and barely escaped with his life. In the late '20s he became known as General Chang Kai Ching, and he served both the Nationalist and Communist governments over a 15-year period. The end came for Bert Hall in 1949. The man who had fought so valiantly abroad died in an automobile accident after suffering a heart attack while on a honeymoon trip in St. Michael. He was 55 years old—but of the founders of the Lafayette Escadrille.

### Heritage of the Air

One of the most inspiring chapters in the history of technical evolution is the story of the men and flying machines of World War I. It is the highly permanent story of brave men—and the sword, spear, bow and rudimentary technologies that overcame man's power in warfare. Today, Leach Corporation celebrates the 45th year in electronics with the presentation of this Heritage of the Air series.

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Technical Director for Heritage of the Air is Lt. Col. Klembrugh S. Brown, USAF.

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## RAF Lightnings Begin Performance At Farnborough

Blurred by the searing blast of their afterburning Avons, English Electric Lightnings of 74 Squadron, Royal Air Force, roar off the main runway at Farnborough, England, to begin their nine-man aerobatic routine at the SBAC show.





## Scrappy fighter with a seven ton punch

August 10, 1961: an F-105 crouched on the run way of Eglin Air Force base. Clutched to its belly and wings were twenty-six 565 pound bombs. Carrying more weight than a Flying Fortress, with no auxiliary assistance, the Thunderchief climbed for the overcast. When the simulated strike was completed, the F-105 had smashed every weight/size record in the logbook. Plus: it can carry 4000 different weapon combinations, including thermo-nuclear. Can qualify for 15 different missions. Can support Army ground troops at 250 mph, can hit the enemy at 1400. Will strike any target, any time, in any weather. Is now with the United States Air Force, here and over Europe.

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## MANAGEMENT

# SAC Planes Rated on Combat Simulation

By William S. Reed

Fairchild AFB, Wash.—Combat crews participating in the 11th annual bombing competition held here by the Strategic Air Command were compared entirely of Boeing B-52 and B-47 wings.

Crews and aircraft of the Royal Air Force Bomber Command were unable to participate this year because of commitments to the North Atlantic Treaty Organization and the necessity of staying at station.

Also absent from the competition were the Convair B-58 Hustlers along with their crews from Carswell AFB, Tex. and Bunker Hill AFB, Ind.

A reputation of the Thunder's success in last year's competition at Bergstrom AFB, Tex. (AW Oct. 1, 1960, p. 48) was questioned, according to SAC, because the two wings are concentrating on upgrading crews as rapidly as possible to combat nuclear strikes.

No other fraction, not even participation in the bombing competition, is allowed to interfere with the training schedule.

This year crews were scored for the fine tune on pilot technique in the intricate phase of the mission. Points were added to the overall scores achieved by bomber and tanker crews for reaching an expected approach time within 15 sec., for landing procedures and for general technique during an ILS approach and landing.

### Highest Score

Highest score posted in competition for the Fairchild Trojans awarded to the top bomb crew was 2,172.67 points out of a possible 2,500. The record went to the 4137th Strategic Wing at Robins AFB, Ga., which scored 1,025.7 and 990.6 points for each of its two Boeing B-52 crews and 157.17 points in the warzone landing competition. Highest possible score for a bomber crew was 1,000 points. A maximum of 200 points was possible in the warzone landing competition and was scored on procedure, navigation, fuelability, safety and time.

Highest bomber score, 1,025.7 points, was turned in by a B-52 crew commanded by Capt. A. M. Calamus of the 4137th Strategic Wing. B-52s took the first four places in the competition. A total of 24 missions were flown by bomber crews on the two nights of the competition. Six B-47 missions and six B-52 missions were

flown on the night of Sept. 17 and the same number on the night of Sept. 19. Bombers were supported by six KC-135s and four KC-97s on each of the competition nights. Altogether, 14 missions were flown by 34 crews in 27 sorties.

### Bomber Crews

Bomber crews were scored on seven aspects of their simulated missions: the accuracy of punch being avoided for navigation and bombing. Points were subtracted from scores for each mile of circular error (CE) in hitting a target on a high and a low altitude selected

navigation leg and for the CE in feet from the target on two high and low altitude bombing runs. The CE's on all bombing runs were a matter of feet. Some typical errors in navigation were 4.7 mi. on high altitude and 2.07 on low altitude. Distances were credited by means of ground radar and where available, instrument radar of Army Nike sites were used for tracking the SAC's own.

Points were awarded on a qualitative basis for electronic countermeasures runs, including a local defense run and a radio simulation run.

Following, both the time required



CREW OF A B-52 seen for the aircraft during a practice shot prior to the Strategic Air Command bombing competition at Fairchild AFB, Wash., recently. SAC scored on ground shot just by capable of being airborne within 15 min. after receiving unsolicited. Nike missiles in size of B-52 launch; there wing root of the month. KC-135 tanker aircraft are parked at the end of the shot ramp.



## Radio Tracking and Computer Techniques to Return Re-usable Boosters and Space Vehicles

The high kinetic energy of vehicles returning from space and orbital missions creates a problem in energy management. Any system intended to perform such an acquisition and terminal guidance function must have sufficient range and accuracy to pinpoint a vehicle which has re-entered the atmosphere and is still traveling at velocities up to 15,000 f.p.s. This energy must be dissipated, avoiding overheating and overstraining the craft, while the vehicle is safely guided to a normal landing at a designated landing strip.

General Electric Company's Defense Systems Department has an automatic landing system under development which utilizes a precise track radar, a radio-command beacon aboard the vehicle and a digital computer installed in a control van on the ground—all equipment currently in production.

Direct communication with the re-entry vehicle is achieved to maintain a command link for guidance signals and safe energy management. The new landing system is applicable to returning space vehicles and reusable booster modules, and is transportable by air or truck. It has been "flight tested" in simulated computer

flights and is ready for implementation and application to a specific vehicle. It also will be tailored to the specific vehicle's characteristics.

For further information on how to incorporate radio tracking techniques into your vehicle recovery system, write: Defense Systems Department, Dept. 568-108, Syracuse, New York 13210.

The Defense Systems Department's landing system incorporates the use of an AN/TP-42 500-ke, a C-6733 Digital Computer and Mod 502 Antenna (Transponder and Decoder). Total airborne weight—about 25 lbs.

DEFENSE SYSTEMS DEPARTMENT  
A Department of the Defense Electronics Division

GENERAL ELECTRIC

SYRACUSE, NEW YORK

and the quantity of fuel transferred, also figured in the total of points as available as well as other procedure—preparation and reaction—point techniques. The score of 1,627.7 points awarded by Columbia and her crew represents a nearly perfect mission from the rigid scoring standpoint. Even the crew with the lowest score in the competition is considered "three stars", having been a winner in eleven out of twelve events as the home base.

### Tanker Crews

KC-119 and KC-97 tanker crews were subject to similar scoring methods, with the emphasis placed on wheeling maneuvering and transfer techniques and in high altitude refueling maneuvers. Alert procedures and pilot techniques applied by the tanker crews were the same as those for which the bomber crews were scored. Top score of 513 points out of a possible 1,040 was achieved by the 14th Air Refueling Squadron of Hahn AFB, Fort Worth, Texas, doing KC-119s. However, the top KC-119 crew was commanded by Capt. B. T. Naper of the 99th ARS from Seymour Johnson AFB, N. C. First of the top three out of 13 KC-119 and 12 KC-97 missions were taken by the KC-119s. Average of the scores of the two refueling crews from a base were considered in the award of the Squadron Trophy so that it was not necessary the top team which figured in the scoring would win. In that case, Naper and his winning team averaged 313 points whereas the winning team from Keesler AFB averaged 303 points.

All phases of the mission were during the competition were considered by experts assigned to a control evaluation group. At least one expert made close as in observer in each aircraft. Officers monitored the crew during the period they were in the assembly area. Mission transfer and the aircraft commander's time was announced at 5:55 p.m. At the beginning of the start, the expert presented a ground assessment. It varied in length, never over 10 minutes. The pilot, copilot, navigator and crew chief assembled aboard at 9:01 while the navigator and boom operator stood by guard on either side of the aircraft. The first engine started to turn at 9:04 and the last two engines pumped should shortly thereafter. The start commenced at 9:05 with the aircraft being guided by an start vehicle at a minimum of 25 mph. Because of a technical error, the start was cancelled in leaving out, a condition which would not start at the home base but was detected by control commands at Fortwell. Full throttle was applied for a running start at 9:11 p.m., 15 min after the launch started the whole chain of events. The preflight engine check, normally accomplished at the runway's

sometimes radically, as practice were submitted to the CGO committee. One can about was awarded during the competition. KC-97 failed to take off on the first night of competition.

### Maxima Observed

Some insight into the hard work and concentration the crews put into the missions was afforded by Air Force Writer who rode to observer on one of the KC-97s on the second night of flight, a 6 hr. 10 min. mission covering 1,400 mi. over the states of Tennessee, Georgia, South and Alabama. The aircraft was KC-97 number 58-0107 commanded by Capt. C. R. McGovern of the 110th Air Refueling Sq. at Schilling AFB, Kan. This crew scored overall 413.5 points out of a possible 595, placing first among 13 KC-97 crews.

The crew had been allowed 2 hr. for briefing at the mission, the precise timing of which was not revealed until the time of departure. Briefing time was from 4 to 5 p.m. in which the crew knew only that the assembly location would occur somewhere between 6 p.m. and midnight. Even in the afternoon, the aircraft had been loaded and weighed, and everything set in the "locked" condition. The aircraft weighed 18,000 lb. of JP-4 for transfer in a mission mission and 51,000 lb. of surface fuel hanging the aircraft gross weight 34,000 lb.

Once the aircraft was loaded no one was allowed to approach it. Weapons stood guard to ensure that the aircraft was not entered and the assembly was given. An observer was made for the aircraft they could be stopped in and out of the crew's was prior to the start.

### Scramble Ordered

McGovern's crew waited in the back from the start, but they waited until the launch transfer and the aircraft commander's time was announced at 5:55 p.m. At the beginning of the start, the expert presented a ground assessment. It varied in length, never over 10 minutes. The pilot, copilot, navigator and crew chief assembled aboard at 9:01 while the navigator and boom operator stood by guard on either side of the aircraft. The first engine started to turn at 9:04 and the last two engines pumped should shortly thereafter. The start commenced at 9:05 with the aircraft being guided by an start vehicle at a minimum of 25 mph. Because of a technical error, the start was cancelled in leaving out, a condition which would not start at the home base but was detected by control commands at Fortwell. Full throttle was applied for a running start at 9:11 p.m., 15 min after the launch started the whole chain of events. The preflight engine check, normally accomplished at the runway's



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**Anso**

Industrial X-ray

and is deleted in the SAC checklist since the crew realize that if the air goes checked out earlier in the afternoon they didn't need another bright ramp which bore up of such importance.

The aircraft was hoisted for a run down the runway, a B-52, and clouds were commenced by an altitude of 14,000 ft. The aircraft called for a roll of two KC-97s each to offload 10,000 lb of fuel to the B-52. This aircraft was leader of the roll and therefore had no transfer fuel. The check on route to rendezvous with the bomber was completed at 9:44 p. m.

Initial radio contact with the receiver aircraft was established at about 10:20 and the transfer operation between the second KC-97 and the B-52 could be observed. Although during the refueling was 170 lb. 188 with the number two aircraft positioned one half mile ahead of and 500 ft above the leader. After experiencing some difficulty getting fuel from the second tanker, the B-52 swung into position behind the lead aircraft and refueling proceeded quickly.

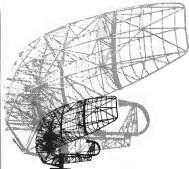
#### Boom Extended

Within seconds after the B-52 came into use through the boom operator's window, the operator extended the boom and successfully made contact with the bomber. Although some vibration in position was observed during the operation, a disconnect did not occur and the full amount of 10,000 lb of fuel was transferred in short order. From the time the B-52 came into position at 11:00, only 5 min. elapsed until it was on its way with 30,000 lb. more of fuel. An unusual phenomenon was noted during the refueling operation in that the noise from the B-52's eight jet engines could be heard clearly in the KC-97, rising and falling in power as the boom was extended and retracted.

A three-hour operation log was started at 11:45 p. m. terminating at the vicinity of Seattle, Wash., at 2:45 a. m. This portion of the flight was conducted at 15,000 ft at a true air speed of 215 kt. with the only source of navigation used being celestial fixes. Even so, the navigation log was only 2.5 min. in, as noted by ground radar sites. The crew received 117.5 out of a possible 140 points for navigation.

Bottom trip to Bunker AFB was completed at 15,000 ft and after a lot down, holding procedure and an ILS approach, all of which were guided by both the master aboard the aircraft and noted by ground radar, the flight landed at 3:39 p. m.

Despite the late hour, the crew went immediately to the scoring center after midnight briefing to await the scores even though a good catch 17 in factors over preliminary scores were posted.



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#### PRODUCTION BRIEFING

Application of a laminated sandwich material as wall and outer restraint case for high strength, light weight characteristics is being studied by North American Aviation's Space and Industrial Systems Division, Downey, Calif., under contract with the Force's Aeronautical Systems Division. NAA will conduct feasibility study and construct and test subscale and full scale models.

Space Technology Laboratories, Inc., has received three new contracts totaling \$177,000 from the National Aeronautics and Space Administration's George C. Marshall Space Flight Center. One contract is for developing formulae for estimating cost of space vehicles in the Saturn to Nova range having liquid fueled, non-reusable first stages and nuclear powered upper stages. Second contract is for comparing methods of assembling and checking Saturn and Nova class vehicles in vertical and horizontal positions. Third contract relates to study of control and dynamic stability problems expected in operating Saturn and other heavy space vehicles and in the development of a minimum-complexity control system.

Weber Aircraft Corp., Bufilets, Calif., will design and construct the spinout unit and structural system for the Dynaflex manned space glider under a contract approximating \$600,000 from The Boeing Co.

J. W. Fisher Division of American Optical Co., Southbridge, Mass., has received a \$1,077,494 contract to develop two looking optical telescopes for USAF's Mach 6, Altitude Range 30,000 Telescopes will be mounted aboard two ships which are being converted into floating observation stations along the Atlantic Missile Range. The work results will be used in photographs as early as possible and space vehicle.

Cape of Engineers has awarded an \$8,311 contract to Rahn Construction Co., Port Connally, Fla., for construction of a 1,474-sq. ft. building to store test equipment for Maryland ICBM test facilities at Cape Canaveral. Cost may also call for addition in two existing buildings for use in receiving and inspection structure.

Arthur Voncken Co. of Washington D. C., has received a \$2.5 million contract from National Aeronautics and Space Administration's Goddard Space Flight Center for construction of the center's eighth of 10 major structures—Satellite Station Building—on a 510 sq. ft. site near Greenbelt, Md.



#### Taber Transducer keeps close tab on autoclave air pressures at Twin Coach

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Flying nearly 15 miles a minute, at times less than 100 feet above the ground, a McDonnell Phantom II swept through a measured 3-kilometer course in 7.5 seconds to capture a record that has stood for eight years.

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The old record of 763 mph was held by an XF4D. The Phantom II skinned through the hot desert air at an average speed of 202.77 mph.

The record run, code named "Operation Sageburner," emphasized the low altitude attack capability of the U. S. Navy's newest all-weather air defense and ground attack fighter. In previous record setting flights, the Phantom II climbed to 98,567 feet, set world's 100 and 500-kilometer closed course speed marks, and flew coast to coast in 139 minutes.

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**D RECORD**



*CAR Accident Investigation Report:*

## Icing Caused Capital Viscount to Crash

At approximately 2210 E.S.T., January 15, 1980, a Capital Airlines Viscount N 766L, en route from Washington, D.C., to Norfolk, Virginia, crashed and burned near Charles City, Virginia. All 48 passengers, including two infants and the two crew members, were killed instantly.

The Board believes the accident was caused by the delayed closing of the engine air protection systems while flying through icing conditions, causing eventual flouage of the four engines. The conditions existed for sufficient time to cause a drop in battery electrical output, and caused the airframe to

ing and edging of sufficient organs to maintain flight. The aircraft was then driven as close to water surface as possible to draw the propeller out of the flooded section to avoid stall. At the same time,

Multiple attempts were made to abduct one or more captives. Successful flights were either interrupted by anti-fighter action mounted by premature advancing of the fighters prior to complete light up of an engine or prevented by consistent battery

financial strategy. No. 4 engine was eventually sold and the store had just successfully sold No. 1 engine when the accident ensued.

As a result of this incident, Capital Air has dropped the plane, "designed to winner aircraft," from its regular company checklist and instructed all Vermont pilots that flight could be accomplished at any altitude if proper drill was followed. Capital Airline then adopted a culture of disclosure when it accepted that there had

**Extinction**

## Investigation

Captain Anthony Flaherty, 20 of January 10, 1960, requested in Chicago. Safety Act and was in command of Norfolk, Virginia, with a stop at Washington, D.C. The purpose of the flight was an aerial survey of the Washington, D.C. area which began at Washington, D.C. at which time a Victor 2 was scheduled to fly over the Potomac River. The flight was cancelled because of weather conditions. The flight was cancelled because of weather conditions. The flight was cancelled because of weather conditions.

At the time of dispatch N 3462 had a basic operating weight of 40,315 pounds. The manifest shows 1,047 pounds of cargo, 41 passengers for 7,260 pounds, 481 pounds of water (fuel tank) and 17,600 pounds of

(40) three  
found in 1971

## SAFETY

The maximum takeoff gross weight 10/35 at Washington port is 84,500 pounds. The coffin gross weight for loading at 1945 pounds.

was hoisted on the amplifier by dispatcher prior to dispatch, directed the Washington Na-

were made at increasingly lower altitudes.

Many situations behind the aircraft was experiencing those type of engine difficulty.

Application and removal of power, at cutting on and off of the engines, occurred at least three times. There was a final air power gain before impact which occurred at approximately 1200.

Wreckage Area

The wreckage area was located 3.6 nautical miles on a bearing of 067 degrees from the Hopedale VOR station. This is a point approximately 6.3 nautical miles east of the tip of the Hopedale peninsula.

The wreckage was confined to the same debris area of impact, and no damage to the trees in the surrounding area could be found. All trees that did show impact damage were within the lateral dimensions of the aircraft.

The aircraft struck the ground on a heading of 192 degrees magnetic, wings approximately 151 and in a pitch attitude of about 100 degrees nose up.

The coverage was reported on 6/1 from two through each wing and ran through the tail cone. Study to 74 foot high trees also furnished the nose wings and tail. Most of these trees showed no insect activity.

Shortly after impact, the converted the wreckage and caused considerable damage from the rear to the rear passenger terminal as well as through the entry wing section to the tail section of Nos. 1 and 2 engines.

There was no evidence of fire structural failure prior to impact, and all major failures and separations were due to gross conformity of the structure from impact and damage by debris and prolonged heat. All structure was accounted for at the accident site.

The primary field control surfaces were in good condition and operable although damaged by heat and impact. The gas tanks were found in the 'OFF' position. The engine, field control system, main

[illegible]

The two tasks were set for eleven control, eleven degree nose up, and three degree nose right.

The leading gear, flap, and landing lights were in the indicated positions.

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and more.

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also an individual with feathering feature. The propeller will auto-feather at any time the feather setting is pulled for an engine output of 13,400 p.p.h. or above and there is a loss of torque below 50 p.p.h. During the right sequence, if the feather should be moved from idle to coarse before the engine rpm reaches 13,400 p.p.h., and the torque does not build up to 10 pounds p.p.h., the propeller will return to feather. If the feathering is resisted to a point below 13,400 rpm and a feather moment, the propeller will roughen itself. Under the condition, if the feathering is then allowed to a position above 13,400 rpm, the propeller will auto-feather.

If an attempt is made to fight by actuating the feathering switch, but without closing the high pressure valve and therefore, the propeller will not feather. The propeller can be manually feathered by moving the high pressure valve lever to the feather position and then depressing the feather switch for each engine. When the feathering switch is manually pulled, the feather pump operates to supply oil pressure to feather the propeller. The feathering switch is designed to start the high pressure pump for 30 seconds.

Subsequent to the accident, a flight test was conducted on a Vindicator 7000 series jet with an effort to establish the range between the type used about 1946 when no previous papers in available and while approximating the electrical load which was believed to have been carried at the time the emergency occurred. The flight test revealed that with the test engine "OFF" and a continuous electrical load of over 350 amps, pressure to be

lost for the same electrical load as that of the light aircraft, the aircraft battery would hold, within 15 to two minutes, to below the required voltage necessary to successfully feather a propeller and might in engine.

The flight test further revealed the compressor pressure required to drive the propellers out of feather by undersizing. Approximately 190 lbs. of pressure was required to drive the outboard No. 5 engine out of feather, and approximately 180 lbs. of pressure was required to drive the outboard No. 3 propeller out of feather position.

### Aspen

Shortly after departing from Washington, Capital Flight 33 would have been in the clouds and would have remained in the clouds during a substantial portion of its climb to the cruising altitude of 5,000 feet. While the aircraft probably was out of clouds a portion of the time it is noted that it is considered that it was in clouds more than half of the time or approximately 10 to 15 minutes. During this period and prior to descent near the accident site, the aircraft would have been experiencing intense turbulence. At the same time, Flight 33 would have encountered light and dense cloud layers above.

Cloud tops along the route were generally from 10,000 to 11,000 feet and could well have been lower locally. Callings ranged mostly between 100 and 400 feet with visibility from 1/2 to 1 1/2 miles. Clouds were layered with the top of the lower deck about 6,000 feet and the tops of the lower deck between 3,000 and 4,000 feet. The

site was associated with the fog at a number of locations, while rain showers of varying intensity occurred along the route.

A small but extensive long-range aircraft and its associated flight structure moved northward from south of the accident site to a location about 15 miles east-northeast of the site of the crash of the accident. The system was accompanied by high gusty winds, heavy showers, turbulence, and some lightning, severe activity and hail. Pilot reports, radar reports, and ground-based instruments indicated quite clearly that the latter weather conditions affected neither the immediate area of the accident site nor the route from Washington to the accident.

The freezing level in the Washington area was near 5,000 feet, while the temperature at 5,000 feet was near 5°C. The temperature at 5,000 feet over the accident site was approximately near 4°C, and the freezing level was near 6,000 feet. Given descending below 6,000 feet near the accident site Flight 33 would have encountered temperatures above freezing. The aircraft would have broken out of the upper cloud deck at this altitude and would have entered the lower clouds at about 5,000 to 4,000 feet. From this altitude to ground level, the aircraft would have been in clouds with the possible exception of the final 100 to 400 feet. Light-to-moderate turbulence would have been encountered.

This is the last half of the Civil Aeronautics Board accident investigation report on the crash of a Capital Airlines Flight 33 on June 19, 1968 near Charles City, Mo. The concluding portion will be published in a future issue of AVIATION WEEK.

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## CAPISTAL RECREATIONS 87



What is the lowest number that at the rate of two calls in two different ways?

—Continued

The KA-1651 signal-activated cassette tape recorder from the Western division of Litton Systems, Inc. records at the drop of a voice, automatically stops the tape and sets the tape at the tape. Operates at a tape-reversing speed of five-inches inch per second. Details are in an illustrated four-page brochure. Ask for Bulletin 3-2 at Western Research Equipment Department, 333 No Maple Dr., Beverly Hills, Calif.

ANSWER TO LAST WEEK'S PROBLEM: There are no primes in this series. Consider the first nine members, the highest of which is 987,654,321. Eliminating even numbers and the five ending in 5, leaves those ending in 0, 1, 3, and 7. But the digital sum of each is either 3 or 6 making them all divisible by 3. Next, any number higher than this number will repeat the same digital sum since the digital sum of this number is 9.

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[illegible][illegible]

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Through the sophisticated use of hydraulics and air, IBM engineers and scientists have developed the IBM 1500 disk storage. In this new disk inventory, a hydraulic actuator continuously positions 40 magnetic data heads to read and write on magnetic disk surfaces. The specific design of the hydraulic actuator combines speed, accuracy and reliability. The magnetic heads glide on a self-acting air bearing which responds to external air supply fluctuations at precise distances above disk surfaces, up to 100 microns by air flow, measured by the sensitive dis-

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## Kudos for Dornberger

Congratulations to Dr. Dornberger for his excellent article (AM Sept 18 p. 17) and to Aviation Week for printing it. Amidst our national defense panic it is not often one comes across such a sensible analysis. Of course the article will probably be discounted by responsible government pages. Let's face it, the pure logic and simplicity will stagger them.

J. C. Dobbins  
Vermont, Ca.

In response to the flood of mail which I am sure you will receive at "Aviation Week" to Dr. Dornberger's excellent article in the Sept. 18 issue of *Aviation Week*, I would like to add one more—Dornberger for a man who believes what he says—and says what he believes.

I am, and have been for a long time, an ardent and, at times, a vocal adherent of the principles and ideas advanced by Dr. Dornberger. I have been critical of the President Eisenhower for (1) his statement that "there is no military job for you," and (2) for the same president's other less dignified or the psychological propaganda view as he derived from U.S. schoolchildren in Spain.

Like Dr. Dornberger I feel that our system is and probably will continue to be "overcapitalized" and, too, that we are always too heavily motivated by fear—fear and genuine delays of the "disarmament." Surely that was the reason that we can never regain.

In regard to the letter page, I think that President Kennedy is not a Republican, is certainly not a conservative and is certainly not one of his countrymen to back through the communications barriers and produce these regularly needed decisions on a much more realistic base also. Let us hope so.

There are many of your readers who will heed Dr. Dornberger's article as typical "Common sense reasoning." Sure! Sure it is, and if the one logic it will reason, a sane country, then those people can and must be heard. But I would like to see a group of the percentage of our great ones read your column on the subject.

As an average American, I am now paying, at any given moment, semi-annual, an education—about \$7,500 per year in some cases. If concentration, embracing Dr. Dornberger's ideas, should denote greater government spending, I will cheer. Dr. Dornberger has proven at any moment the basis of a better, more rational thinking Americans will do the same.

I would like to know how American rights permit to state that the Russians are right on proving that the "best defense is a good offense." I can think of no other reason why no American citizen should not become as Dr. Dornberger advocates, as aggressive and "offensive" as he is.

Dr. Dornberger is something the Russians can understand.

Maxwell M. Atkinson  
North Andover, Mass.

*Aviation Week welcomes the opinions of its readers on the issues related to the magazine's editorial columns. Address letters to: Editor, Aviation Week, 330 W. 42nd St., New York 36, N. Y. Try to keep letters under 300 words and give a genuine identification. We will not act on anonymous letters, but names of writers will be withheld on request.*

## Explanation Wanted

Relative to your article entitled "Space Patrol: Editor Fiscal Challenge" by George C. Wilson in the Aug. 25 issue of *Aviation Week* and Space Technology (p. 20), further explanation is requested.

The statement "An Aviation Week study indicated that only a fraction of the investment made under NASA contract can actually be accounted for in the space agency" is a challenging one. If you have actual evidence of unaccounted funds but not reported that is one thing, but if the statement is a generalization based on the reporting you discuss, the statement may be questioned.

Since NASA delays "investments" in vehicles, launchers and "improvements," the "investments" reported are a function of such establishment's interpretation of "improvements" and "investments" and the significant background of the people there involved.

How many "impossibly possible" more there will NASA's 1971 "investments" support?

You would not then reporting matter in better perspective if you pointed out the percentage of NASA's expenditures.

LORENZO B. ROBERTS, MEMPHIS  
Area Public Department  
Memphis-Henryville Supervisor Co.  
Memphis-Henryville Supervisor Co.  
Memphis, Miss.

## Imagination Gap

The current air show at Tuscon demonstrates that while we in the United States have been saying about the necessity of improved hardware, the Soviets have been developing and building weapons of mobility. No doubt we need about a Soviet Boly of a volume of \$2.25 billion aircraft before we can even get on again of space development into a weapon system (civil program). Need has to do with such a crash program will end up coming far more than an orderly development sustained at the proper time. It does not seem to me to be a matter of letters and editorial about the "bombing gap."

Actually, neither would be more money than that the Soviet Union should take the lead in development and priorities of support borders.

This is because:

1. We have had a significant lead in this field. No excess can be made about a late start.

2. Our military parties require modern hardware to be the greater extent, than the Soviet. This is because we openly publish the location of our military installations.

shows the Russian (Soviet, Soviet) could long show more. Thus, we have to have lead for attack vehicle, depth of testing and demonstrating things there do they.

We are fortunate indeed, to have a Com group sufficiently modest to appreciate leads to try our modest leader capability at a high level. Perhaps the workings of our domestic system will pull us through after all—despite the "conclusive gap" of the Pentagon budgetary.

Q. PETERSON, JR.  
Cambridge, Mass.

A few years ago, when the Russians announced they were scrapping "obsolete" nuclear assets and very concentrating on missiles, we inevitably followed suit. When Vietnam came up, they spent about \$100 million suddenly found themselves back in the money. When the Russians stopped testing nuclear bombs, we also stopped. As it our about time we started thinking for ourselves? The Russians are doing what they believe is best for Russia. It does not necessarily follow that this is best for the United States. We do not have people who can make decisions other than follow the Russian lead. The idea of putting a Russian as adviser to our President is a per se system, not just the reality what we have.

Most of the criticism aimed at the "missile defense" project is based on the fact that we are of such a nature, although several excellent reasons exist the most important one is that if we don't get to the moon the Russians will get there first. Big deal. If that is the only reason by all means let the Russians go their way, then what will then do? Certainly, it is important that we get to the moon, but really not simply because don't what the Russians are doing.

There is no question that we should know what if our opponents are doing and that we should design our offensive and defensive weapons to match theirs, but that should not become our dilemma. Instead of having our status defense philosophy change every time a Russian leader makes a speech or the Russians hold an air show, it should be to have them spend vast sums of money and effort obtaining our weapons systems.

GEORGE PETERSON,  
New Brunswick, N. J.

## Design Competition

Your article entitled "Brush Audio Sola Collector Model" in the Sept. 18 issue p. 94 does not mention that the model was introduced as part of a competition design contest for the design of a new audio collector model.

Audio Sola Collector Model was designed by a 15-year-old student in the design of a new audio collector model.

Brush Audio Sola Collector Model was designed by a 15-year-old student in the design of a new audio collector model.

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## EARTH'S EYE TO THE SKY

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